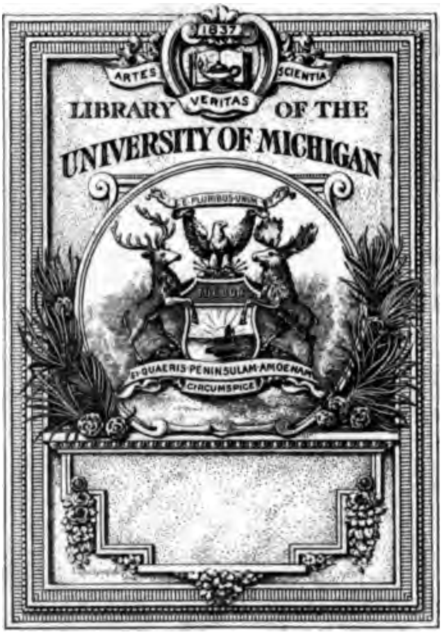
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ANNUAL REPORT

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OF THE

SECRETARY OF THE NAVY

FOR

THE YEAR 1888.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1888.

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REPORT

OF

THE SECRETARY OF THE NAVY.

NAVY DEPARTMENT,
Washington, December 1, 1888.

To the President:

The presentation of this annual report affords an appropriate occasion for a brief review of the condition of the Navy as it will exist on the 4th day of March, 1889, in comparison with the same as it existed on the 4th day of March, 1885. An opinion can thereby be formed, not only as to what has been done, but as well what remains to be done toward the creation of a Navy appropriate to a country with the resources and commercial interests of the United States.

In March, 1885, the United States had no vessel of war which could have kept the seas for one week as against any first-rate naval power, and was dependent upon English manufacturers for the forgings of guns, for armor, and for secondary batteries (this last item including machine and rapid-fire guns). It became necessary, therefore, to consider what the policy of the Government should be with reference to the creation of its implements of war; and it was determined that the United States ought to be independent of all other countries in that regard.

In the annual report of the Department for 1886 the matter was referred to as follows:

At the present time and for many years to come, in the event of a conflict with either a first or second class naval power, it would be quite impossible for the United States, as at present situated, to produce within its territory either the armor required for armored ships or the guns necessary for their armament. Nor would it be possible for the Navy of the United States to protect such articles in transit across the ocean in time of war. As at present situated the country would be entirely defenseless in the absence of any ability to produce armor or the larger high-powered guns. * * *

It is certainly a most lamentable circumstance that a country like ours, with its immense products of iron and steel, should be content to be dependent upon the manufacturers of any other nation for the fabrication of armor and high-powered guns, both of which are now essential and indispensable parts of a modern fighting ship.

Whatever its commercial policy may be, in the production of its necessary implements of war, it should certainly be independent. * * *

This policy involves delay in the construction of the first vessels authorized, but at the end of five years the country would, by pursuing it, be independent and in a much stronger position in every respect than would result from any other course. * * *

The adoption of a definite policy as above indicated involved a delay in the construction of all classes of armored ships of at least three years, but was determined upon without hesitation as the only course consistent with a proper regard for our national dignity and pride. The efforts of the Department were, therefore, in the first instance devoted to the problem of domesticating in this country the industries for the making of armor and of the forgings for high-powered guns.

As a first step in this direction all purchases of armor and gun steel abroad were discontinued. Contracts were pending in March, 1885, for armor and gun steel purchased in England, amounting to $227,365.29. The final payments upon those contracts made subsequent to that date amounted to about $100,000; no further purchases of either armor or gun steel have been made abroad since March, 1885.

As a second step, the wants of the Department for armor and gun steel were allowed to accumulate until contracts of some magnitude could be offered to the competition of domestic manufacturers, one condition of the bidding to be the erection of a plant in this country adequate to the manufacture of both armor and gun steel up to the highest standard of European requirements.

This was deemed an experiment by the Department at the time, and was accompanied with great individual effort towards enlisting the steel manufacturers in the undertaking, but resulted successfully, and upon the 1st day of June, 1887, contracts were entered into with the Bethlehem Iron Company of Bethlehem, Pa., one of the largest and most enterprising of American steel manufactories, under which the United States was guarantied that within two and one-half years from the date of the contract this country would have within its borders a plant equal to and probably the superior of any in the world for the production of armor and the forgings for high-powered guns. This, in the judgment of the Department, must be deemed to have been the first important step towards the creation of a navy modern in character.

In view of the general congratulation with which the making of these contracts was received, it is proper to say that the Department in that regard reaped very largely the rewards which belonged to others. The subject had been previously investigated and reported upon by two special boards, the Gun Foundry Board, Rear-Admiral Edward Simpson, chairman, and the Board on Fortifications and other Defenses, presided over by the Secretary of War, both boards having for members Army and Navy officers of high standing and attainments upon the subject of ordnance; and further by the two special committees; of the Senate, Senator J. R. Hawley, chairman, and of the House, Representative S. J. Randall, chairman. But for the thorough elucidation of the

subject which had thus previously been made, and through which the conditions of the problem had been thoroughly made known, it is not likely that the efforts of the Navy Department would have been attended with success.

The Department was especially indebted to two of its own officers, Lieut. Commander Francis M. Barber, U. S. Navy, and Lieut. W. H. Jacques, U. S. Navy, who, from their familiarity with the subject as well as the high order of their talents, aided greatly in supplying the necessary information to domestic manufacturers, and seconded in every way the efforts of the Department toward enlisting practically companies having large resources and capital in the undertaking.

The following is a list of armored vessels heretofore authorized by Congress:

THE NEW NAVY.

[NOTE.—Engine weight of the following vessels does not include engine stores.]

Name.	Length between perpendiculars.	Breadth, extreme.		Mean draught.		Displacement.	Maximum I. H. P.	Type of engine.	Weight of machinery.
	Feet.	*Ft.*	*In.*	*Ft.*	*In.*	*Tons.*	*I. H. P.*		*Tons.*
Maine	310	57	0	21	6	6,648	*9,000	Twin screw, vertical, triple expansion.	890
Texas	290	64	1	21	6	6,300	*8,600	......do	816
Coast defense	250	59	0	14	6	4,000	*5,400	Twin screw, vertical, inverted, triple expansion.	431
Puritan	280	60	1½	18	2	6,060	†3,058	Twin screw, horizontal, compound.	‡1,260
Terror	250	55	6¼	14	1¾	3,815	†838	Twin screw, inclined, compound	546
Miantonomoh	250	55	6¼	14	1¾	3,815	§1,030	......do	569
Amphitrite	250	55	6¼	14	1¾	3,815	*1,000	......do	‖560
Monadnock	250	55	6¼	14	1¾	3,815	*3,000	Twin screw, horizontal, triple expansion.	351
Armored cruiser	.....	.....		.....		7,500	.....	.....	.....

* Estimated. † Dock trial.

‡ According to lines (draught taken before and after machinery placed on board); weight, 1,290 tons, including engine and boiler foundations. Foundation will weigh not more than 80 tons.

ARMORED VESSELS.

[NOTE.—Engine weight of the following vessels does not include engine stores.]

Armor.		Battery.		Condition.
Side.	Turret and barbette.	Main.	Secondary.	
Ins.	*Inches.*			
11	10½	Four 10-inch B. L. R. Six 6-inch B. L. R.	Four 6-pdr. R. F. Eight 3-pdr. R. F. Two 1-pdr. R. F. Four 37mm R. C. Four Gatlings.	Building at navy-yard, New York. Flat and vertical keel-plates nearly all in line on keel-blocks. Frames about one-half bent and ready to be riveted to floor-plate and erected.
12	12	Two 12-inch B. L. R. Six 6-inch B. L. R.	Four 6-pdr. R. F. Eight 3-pdr. R. F. Four 1-pdr. R. F. Four 37mm R. C. Two Gatlings.	Partially laid down on mold-loft floor at navy-yard, Norfolk, Va.
16	16-14	One 16-inch 115-ton B. L. R. One 12-inch 48-ton B. L. R. One 15-inch dynamite gun.	Six 33-pdr. R. F. Three 9-pdr. R. F. Two 6-pdr. R. F. Four 3-pdr. R. F.	*Ready for immediate advertisement for contracts.* Plans and specifications now in Bureau of Construction and Repair, completed and ready for inspection of bidders. Plans of machinery will be completed in thirty days.
12	11½	Four 10-inch B. L. R.	Two 6-pdr. R. F. Two 3-pdr. R. F. Two 37mm R. C. Two Gatlings.	Awaiting completion, navy-yard, Norfolk, Va. Hull, except turrets, side armor-plates, and joiner-work, complete. Steam machinery erected on board.
7	11½	Four 10-inch B. L. R.	Two 6-pdr. R. F. Two 3-pdr. R. F. Two 37mm R. C. Two Gatlings.	Undergoing alterations, navy-yard, New York, for the reception of pneumatic gear for operating turrets, steerer, etc.
7	11½	Four 10-inch B. L. R.	Two 6-pdr. R. F. Two 3-pdr. R. F. Two 37mm R. C. Two Gatlings.	To be completed in four months, navy-yard, New York.
7	11½	Four 10-inch B. L. R.	Two 6-pdr. R. F. Two 3-pdr. R. F. Two 37mm R. C. Two Gatlings.	Hull, except turrets, side armor, and joiner-work, nearly completed. Steam machinery erected on board. Wilmington, Del.
7	11½	Four 10-inch B. L. R.	Two 6-pdr R. F. Two 3-pdr. R. F. Two 37mm R. C. Two Gatlings.	Hull, except turrets, side armor, and joiner-work, nearly complete. Navy-yard, Mare Island, Cal.
......	......	......	......	Building authorized September 7, 1888; not yet commenced; cost not to exceed $3,500,000.

§ Free route trial.
‖ According to lines; weight furnished by Bureau of Steam Engineering, 546 tons.

From the above table it will be observed that, so far as armored ships are concerned, the subject is yet to be treated in a broad way by the Department and by Congress. At the present time the conditions are such that everything necessary to a first-class fighting ship can be produced and furnished to the Department in this country as soon as in the course of construction any element or feature is required; but this has never heretofore until the present time been true, and therefore the consideration of the subject has been necessarily postponed by the Department until the present time.

In the above table the double-turreted monitors will not be ships of a high class. Their completion was recommended by the Department solely as a choice of evils, the question which was presented being, whether several million dollars which had been spent upon them should be thrown away, or the balance necessary to complete them be appropriated.

UNARMORED CRUISERS.

From the foregoing statement it will be observed that the efforts of the Department in ship construction have necessarily, since March, 1885, been devoted to unarmored vessels; *and as to these, the Department is able to report that when the ships in course of construction and those authorized shall have been completed, the United States will rank second among the nations in the possession of unarmored cruisers, or "commerce destroyers," having the highest characteristics, viz, of a size* 3,000 *tons and upward, and possessing speed of* 19 *knots and upward.**

The importance which has been placed upon this branch of naval armament will be appreciated from the statement that England and France possess 65 vessels of the class known as unarmored cruisers. The attention of the world was attracted to the destructive effect which was produced upon the commerce of the United States by the cruisers fitted out under the auspices of the Confederacy in the war of the rebellion. The total tonnage of the registered vessels of the United States had risen year by year until, in 1861, it amounted to 2,642,628 tons; and between 1861 and 1866 it was reduced to 1,492,926 tons, or, in other words, to the point which we had reached in 1849, from which decline we have never recovered. The insurance war risk upon American vessels during the war rose in exceptional cases to as high as 25 per cent.

Sir Charles Wilson, director-general of the ordnance survey of Great Britain, recently stated that—

> "If there is one point clearer than another in the history of commerce it is this, that when a state can not effectually protect its carrying trade in time of war, that trade passes from it and does not return." * * *

And Lord Charles Beresford, lately a member of the board of admiralty, in the same connection stated:

> "To-day one-half of the people in England would absolutely have no bread to eat but for the food that comes in over the sea. It is a matter of life and death for you to protect the commerce, and you have not the ships to do it with." * * *

We can not at present protect our coast, but we can return blow for blow, for we shall soon be in condition to launch a fleet of large and

*For list of such vessels see Supplement, p. 44.

fast cruisers against the commerce of an enemy, able to inflict the most serious and lasting injury thereon.

The one characteristic which an unarmored cruiser must possess is great speed. She must be able to escape from iron-clads and outrun, so as to overhaul, merchantmen. If slower than iron-clads she could not keep the sea, and if slower than merchantmen she might as well stay in port.

An examination of the condition of the Department in 1885 regarding the production of power by machinery showed clearly that the matter required most careful investigation and thorough consideration before entering upon new work. There were pending in March, 1885, contracts for the construction of the machinery of the double-turreted monitors *Puritan*, *Terror*, and *Amphitrite*. The contracts were entered into in 1883. Specifications were furnished by the Bureau of Steam Engineering. From an examination of the characteristics of the machinery of those vessels, as shown in the last table, it will be seen that the weight of the machinery as compared with the resulting power is as follows:

Vessel.	Weight of machinery.	I. H. P.
Puritan	1,260	3,058
Terror	546	838
Amphitrite	560	1,000

This machinery was at least a quarter of a century behind the age. Tested by the amount of power produced by it, and making allowance for nature of trial, etc., the best that could be expected would be an average of 2½ indicated horse-power per ton of machinery. At that rate, in order to obtain a 19-knot ship, the machinery would require the entire tonnage displacement of the ship.

An examination of the state of the art in 1885 led to the conclusion that the machinery of naval vessels ought to be so designed as to produce 10-horse power for each ton of machinery; and it was determined to make that the standard, and to enter into no contracts that were not based substantially thereon.

Plans of machinery were purchased abroad, which upon trial had approximated that result. Bidders were authorized to bid upon the plans thus submitted to competition, or were permitted to submit their own plans, but were obliged to guaranty the results determined upon by the Department under severe penalties for failure and with compensating premiums in case of attaining better results.

It results that all the contracts for the construction of ships which have been entered into since March, 1885, call for the production of power by machinery equal to the highest standards. The efforts of the Department in this matter have been cordially seconded by the bureau chiefs; and it is believed that, at the present time, the Department has reached the point where entire reliance can be placed upon it for the production of war vessels equal in character to those of any other country.

THE NEW NAVY.

Name.	Type.	Keel laid.	Dimensions. Length between perpendiculars.	Dimensions. Breadth, extreme.	Dimensions. Mean draught.	Displacement.	Collective horse-power or speed.	Type of engine.	Weight of machinery.
		Yr.	F. In.	F. In.	F. In.	Tons.			Tons.
Dolphin	Dispatch vessel.	1883	240 0	32 0	14 3	1,485	*2,240	Single screw, vertical, compound.	411
Boston	Protected cruiser.	1883	270 3	42 0	17 0	3,189	*3,780	Single screw, horizontal, compound.	690
Atlanta	...do	1883	270 3	42 0	17 0	3,189	*3,356	...do	690
Chicago	...do	1883	315 0	48 2	19 0	4,500	*5,084	Twin screw, compound, overhead beam.	1,007.51
Charleston	...do	1887	300 0	46 0	18 6	3,730	†7,000	Twin screw, horizontal, compound.	710
Baltimore	...do	1887	315 0	48 6	19 6	4,413	9,000	Twin screw, horizontal, triple expansion.	900
Yorktown	Gun-boat	1887	230 0	36 0	14 0	1,700	†3,000	...do	320
Petrel	...do	1887	175 0	31 0	11 7	890	†1,100	Single screw, horizontal, compound.	130
Newark	Protected cruiser.	1887	310 0	49 2	18 9	4,083	8,500	Twin-screw, horizontal, triple expansion.	850
Philadelphia	...do	1888	315 0	48 6	19 2½	4,324	‡19 knots	...do	900
San Francisco	...do	1888	310 0	49 2	18 9	4,083	‡19 knots	...do	900
Concord	Gunboat	1888	230 0	36 0	14 0	1,700	†3,400	...do	340
Bennington	...do	1888	230 0	36 0	14 0	1,700	†3,400	...do	340
Vesuvius	Dynamite cruiser.	1887	246 3	26 5	9 0	725	‡20 knots	Twin screw, vertical, triple expansion.	247
First-class torpedo-boat.	Torpedo-boat.	1888	138 0	14 6	3 7	99	§23 knots	Twin screw, vertical, quadruple expansion.	47
Cruiser No. 6 ‖ b.	Protected cruiser.	......	......	......	......	5,300	¶20 knots		
Cruisers No. 7 and 8 ‖ c.	...do	......	......	......	......	3,000	¶19 knots		
Cruisers No. 9, 10, and 11 ‖ d.	...do	......	......	......	......	2,000	(a)		
Practice Vessel ‖ e	Practice cruiser.	......	......	......	......	800	....		

* Indicated horse-power on trial.
† Guarantied indicated horse-power.
‡ Guarantied speed.
§ Estimated speed by bidder.
‖ Authorized by act approved September 7, 1888.
¶ Required by the statute.

UNARMORED VESSELS.

Battery. Main.	Battery. Secondary.	Total contract cost of hull and machinery.	Date of act authorizing building.	Contract executed.	Months allowed to complete.	Where built or building.	Condition.
		Dollars.					
One 6-inch B. L. R.	Two 6-pdr R. F. Four 47^{mm} R. C. Two Gatlings.	315,000	1883. Mar. 3	1883. July 23	....	Roach, Chester, Pa.	Commissioned.
Two 8-inch B. L. R. Six 6-inch B. L. R.	Two 6-pdr. R. F. Two 3-pdr. R. F. Two 1-pdr. R. F. Two 47^{mm} R. C. Two 37^{mm} R. C. Two Gatlings.	619,000	..do ...	..do ...	....	....do	Do.
Two 8-inch B. L. R. Six 6-inch B. L. R.	Same as Boston.	617,000	..do ...	..do ...	....	....do	Do.
Four 8-inch B. L. R. Eight 6-inch B. L. R. Two 5-inch B. L. R.	Two 6-pdr. R. F. Two 1-pdr. R. F. Four 47^{mm} R. C. Two 37^{mm} R. C. Two Gatlings.	889,000	..do ...	July 26	....	....do	Do.
Two 8-inch B. L. R. Six 6 inch B. L. R.	Four 6-pdr. R. F. Two 3-pdr. R. F. Two 1-pdr. R. F. Four 37^{mm} R. C. Two Gatlings.	1,017,000	1885. Mar. 3	1886. Dec. 28	18	Union Iron Works, San Francisco, Cal.	Launched.
Four 8 inch B. L. R. Six 6 inch B. L. R.	Same as Charleston.	1,325,000	1886. Aug. 3	Dec. 17	18	Cramp's, Philadelphia, Pa.	Do.
Six 6-inch B. L. R.	Two 6-pdr. R. F. Two 3-pdr. R. F. One 1-pdr. R. F. Two 37^{mm} R. C. Two Gatlings.	455,000	1885. Mar. 3	1887. Jan. 31	12	....do	Do.
Four 6-inch B. L. R.	Two 3-pdr. R. F. One 1-pdr. R. F. Two 37^{mm} R. C. Two Gatlings.	247,000	..do ...	1886. Dec. 22	12	Columbian Iron Works, Baltimore, Md.	Do.
Twelve 6-inch B. L. R.	Four 6-pdr. R. F. Four 3-pdr. R. F. Two 1-pdr. R. F. Three 37^{mm} R. C. Four Gatlings.	1,248,000	1886. Mar. 3	1887. Oct. 27	24	Cramp's, Philadelphia, Pa.	Building.
Twelve 6-inch B. L. R.	Four 6-pdr. R. F. Four 3-pdr. R. F. Two 1-pdr. R. F. Three 37^{mm} R. C. Four Gatlings.	1,350,000	1887. Mar. 3	..do ...	24	....do	Do.
Twelve 6-inch B. L. R.	Same as Philadelphia.	1,428,000	..do ...	Oct. 26	24	Union Iron Works, San Francisco, Cal.	Do.
Six 6-inch B. L. R.	Same as Yorktown.	490,000	..do ...	Nov. 15	18	Palmer & Co., Chester, Pa.	Do.
Six 6-inch B. L. R.	Same as Yorktown.	490,000	..do ...	..do ...	18	....do	Do.
Three 15-inch dynamite guns.	Two 3-pdr. R. F. One 1-pdr. R. F. Two 37^{mm} R. C. Two Gatlings.	350,000	1886. Aug. 3	Feb. 11	12	Cramp's, Philadelphia, Pa.	Ready for trial.
Eight automobile torpedoes.	Two 6-pdr. R. F.	82,750	..do ...	1888. Mar. 1	....	Herreshoff Company, Bristol, R. I.	Building.

a Speed to be fixed by the Secretary of the Navy.
b Cost, exclusive of armament and speed premiums, not to exceed $1,800,000.
c Cost, exclusive of armament and speed premiums, not to exceed $1,100,000.
d Cost, exclusive of armament and speed premiums, not to exceed $700,000.
e Cost, $250,000. To be built by contract in accordance with terms of act approved August 3, 1886.

THE SAVINGS OF THE DEPARTMENT ARE PAYING FOR THE NEW NAVY.

It is gratifying to be able to report that, as will be seen from the following table, notwithstanding the large expenditures for the new navy in the last three years, the reduction in other directions has made the total expenditures of the Department less for these years than for the three years ending June 30, 1884, *the ordinary expenses of the Department having been reduced over* 20 *per cent.*

[The year 1884-'85 was omitted from the table as not having been wholly in either administration.]

Total expenditures of the Department for three years ending June 30, 1884, compared with the three years ending June 30, 1888, items being taken from reports of Fourth Auditor of the Treasury and distributed under the various objects of expenditure:

ITEMS FIXED BY STATUTE OR FOR OTHER REASONS BEYOND THE CONTROL OF THE SECRETARY, INCLUDING ALSO EXPENDITURES FOR INCREASE OF THE NAVY.

Expenditures.	Years ending June 30, 1882, 1883, 1884.	Years ending June 30, 1886, 1887, 1888.
Pay of the Navy	$21,013,825.98	$21,752,116.72
Pay Marine Corps, etc	2,607,937.22	2,574,830.06
Naval Academy	583,023.99	550,909.49
Increase of the Navy	....	2,184,333.88
Vessels and monitors	....	1,163,601.67
Steel cruisers	1,286,353.04	1,412,792.05
Monitors	592,740.75	346,609.10
Testing Clark's deflective turrets	10,461.50	3,849.21
Coaster's Harbor Island	49,838.90	43,651.98
Naval Hospital	242,644.07	212,874.44
Naval Asylum	175,610.34	162,123.42
Naval War College	....	13,990.71
Naval cemeteries	1,439.18	500.00
Navy Yard Commission	1,270.00	....
Naval station, Port Royal, S. C	5,500.00	22,838.08
Tuition naval cadets, Greenwich	900.00	....
Japanese award	11,701.00	....
Bounty, prize money, awards, and reliefs	277,393.84	51,028.89
Arctic Expedition	609,358.52	23,728.99
Mexican war	315.00	79,636.20
Transit of Venus	67,939.71	....
Pay Advisory Board	....	5,171.80
Purchase steamer *Stiletto*	....	25,000.00
Payments, prior, 1881-'82	129,613.31	280,899.56
Total	27,757,866.35	30,910,486.25

ORDINARY BUREAU EXPENSES IN WHICH SAVINGS HAVE BEEN MADE.

Expenditures.	Years ending June 30, 1882, 1883, 1884.	Years ending June 30, 1886, 1887, 1888.
Bureau of Construction and Repair	$4,510,179.56	$2,997,424.86
Bureau of Steam Engineering	3,268,417.62	2,241,193.62
Bureau of Provisions and Clothing	3,887,395.95	4,018,327.77
Bureau of Yards and Docks	2,832,270.57	2,276,389.21
Bureau of Equipment and Recruiting	2,581,080.56	2,066,289.60
Bureau of Ordnance	876,441.13	731,017.10
Bureau of Navigation	511,188.44	826,310.74
Bureau of Medicine and Surgery	319,730.76	272,800.18
Pay, miscellaneous	1,105,820.99	978,593.85
Contingent, Navy	329,005.70	11,797.06
Total	20,221,531.28	15,920,143.99
Grand total	47,979,397.63	46,830,630.24

COAST AND HARBOR DEFENSE VESSELS.

By act approved March 3, 1887, the following appropriation was made:

For floating batteries or rams or other naval structures to be used for coast and harbor defenses, one million dollars. The final cost of said floating batteries, rams or other naval structures, exclusive of armament, shall not exceed two million dollars.

In the last Annual Report of the Department the considerations were stated leading to the conclusion that it would be unwise for the Department to follow the course of the European powers in building unprotected torpedo-boats; and in the present uncertainty regarding the practicability of submarine boats, and while waiting the practical trial of the dynamite gunboat, it has been deemed wise for the Department to build one light-draught, heavily armored, harbor-defense floating battery or ram, for which designs have been prepared by the Bureau of Construction and Steam Engineering, in consultation with the Chief of the Bureau of Ordnance. The advertisements for this vessel call for the submission of bids in the month of February next. The characteristics will be found stated in the table of armored vessels before mentioned.

BUSINESS METHODS OF THE DEPARTMENT.

In each of the Annual Reports of this Department for the last three years attention has been called to its unbusiness-like methods and to the efforts being made to simplify, systematize, and improve them.

In the report for 1885 the following statement appears:

The open purchases of the Navy Department for the year ending June 30, 1885, amounted to $841,285.84, while the purchases by contract amounted to only a little over $1,000,000. A large proportion of the open purchases consisted of articles of either comparatively small value or more or less difficult of classification; but $138,000 of the amount was spent by the seven bureaus, each acting independently of the other, for coal bought, not in one lot, but at 166 several open purchases (this does not include coal bought by ships on foreign stations); 299 different open purchases of stationery were made by eight different bureaus; $121,315.66 was spent for lumber and hardware by six bureaus in 499 separate open purchases. Seven bureaus spent $46,000 for oils and paints in 269 separate purchases; 117 different open purchases of iron and steel were made at an expense of $41,524.48; $68,881.59 was spent for hemp and cordage in 45 different open purchases. Eight bureaus supply stationery to ships; three bureaus supply ships with lamps and lanterns. To the same ship one bureau supplies electric lights and the light for general illuminating purposes; another supplies electric search-lights, and a third oil and light for the engine and fire rooms.

Under this system of purchasing, where each Bureau acted independently of the others in its purchases, and purchased in small quantities and without competition, there had grown up around the Department irresponsible men, not regular dealers in the articles required, into whose hands the orders would fall. The Department was thereby deprived of the security in making its purchases which would result from dealing directly with responsible and well-established business houses.

In the year 1884 90 per cent. of the open purchases of the Navy Department, amounting to about $1,100,000, fell into the hands of six individuals or firms, most of them having no other business but filling the orders of the Department.

In an effort to remedy this abuse orders were made consolidating the business of conducting the purchases of the Department in the Bureau of Provisions and Clothing, with the Paymaster-General of the Navy as the responsible head. The wants of each bureau in the way of supplies are submitted to the Paymaster-General, by whom they are consolidated in classes, and purchased by contract after advertisement.

During the years of 1884 and 1885 over 50 per cent. in value of the supplies of the Department were obtained by open purchases without competition. During the last year the proportion of such purchases was less than 11 per cent., and in the course of the next fiscal year it is believed that the open purchases can be reduced to about 5 per cent.

The naval brokers have for the most part disappeared and regular responsible dealers are becoming more and more contractors for these supplies. For a time it seemed impossible to dislodge them. They would underbid regular dealers, notably for the supply of coal. It was quite evident they had some advantage which did not appear. Careful investigation showed the quality of the coal delivered to be as contracted for. The receiver of the coal was changed at the Brooklyn navy-yard and the weights taken by another civil employé, and nothing suspicious was developed. Finally a naval officer was detailed, without previous notice, to weigh personally a barge-load, and it was found 16 tons short. The gentleman disappeared as a bidder for the Department from that time. There was no evidence of fraud on his part, but inferences can readily be drawn.

PROPERTY ACCOUNTS.

The system of property accounts for the Navy referred to in the last annual report has been in successful operation since July 1. The experience of the first quarter shows that it is simple and that there is no difficulty in keeping pace with current work at the largest stations. The basis of the system is a classified schedule, in which naval supplies of every description are arranged in seventy-one classes. The books at every station lead up to a balance-sheet for each Bureau, which shows for the quarter:

1. The value of supplies on hand under each class at the beginning.
2. The additional receipts.
3. The expenditures, whether for use, condemned, or transferred.
4. The value remaining on hand.

The proportion between supply and demand can thus be seen at a glance, the balance-sheet affording a graphic chart of the volume and current of business. If more detailed information be desired, it can

readily be had from the books. *Quantities on hand* are reported in a separate monthly return, in which items are given as far as practicable.

The quarterly balance-sheets will be condensed in the Paymaster-General's Office by bureaus and stations in such manner as to afford at the end of the year an epitome of receipts and expenditures in every class of naval supplies at every station; balances on hand at the end of the year may be compared with those at the beginning, and any increase or decrease of stock will be unerringly shown. A check upon undue accumulation of supplies will thus be afforded.

Under the new system adopted greatly increased labor and responsibility have been devolved upon the Bureau of Provisions and Clothing, and the business has been conducted with increased faithfulness and ability by Paymaster-General Fulton and his assistants. The Department is indebted in this connection to the two Boards of which Commodore George Brown and Capt. Richard Meade were the respective chairmen for their intelligent and patient labor upon the details of the work.

At first, as was natural, much opposition was felt in the service to these changes in the methods of transacting business.

It is more agreeable and simpler to be able to buy privately and as articles are required, and as the Government pays, the faults of the system are not felt by the service. As time elapses, however, the new system finds more and more friends, and it is hoped will be permanent.

DISBURSEMENTS ON FOREIGN STATIONS.

The disbursements of the Navy Department are, to some extent, required to be made abroad for vessels on foreign stations, and as bills on London are most favorably negotiated in foreign ports, it has been the custom of the Department to have a financial agency in London.

Up to April, 1885, the contract which the Department had had with Messrs. Seligman Brothers, London, called for the payment of 1 per cent. commission for paying drafts, and 5 per cent. interest on advances made by said firm to the Government, and 4 per cent. interest to be paid to the Government on daily balances of its money. The spectacle of the Government of the United States paying 5 per cent. interest for money in London where private individuals were paying an average of not over 2½ per cent., was somewhat relieved by the fact that it was a small sum annually.

A change was however made in this contract April 24, 1885, reducing the commissions to one-half of 1 per cent., and further providing that on daily balances the Government should receive the rate of interest paid by the London joint stock banks, and for advances should pay the rate of the Bank of England. As money was lying idle in the United States Treasury, it has been the intention of the Department to borrow no money in London but keep sufficient there at all times to meet accruing obligations.

The attention of pay officers abroad has been called to the subject of their drafts, and under the instructions of the Department greatly improved rates have been secured.

By careful attention to these matters by the Paymaster-General the Department is able to report that on the items of commission, interest, and exchange, whereas a net loss of $103,493.53 was made in the two years and ten months ending April 24, 1885, for the three years ending June 30, 1888, a net gain of $703.22 was made, as follows:

Comparative statement of gains and losses from commissions, interest, and exchange, from June 30, 1882, to April 24, 1885, and June 30, 1885, to June 30, 1888.

Fiscal year.	EXPENDITURES.			RECEIPTS.	
	Commissions paid by Government.	Interest paid by Government.	Loss of Government from discount on drafts.	Interest received by Government.	Gain from premium on drafts.
For year ending June 30, 1883	$15,943.11	$3,037.49	$3,906.48	$2,884.20	$1,426.23
For year ending June 30, 1884	19,064.11	6,691.84	24,224.56	1,784.65	388.94
From June 30, 1884, to April 24, 1885	14,577.75	3,156.56	14,653.82	2,028.82	3,247.35
Total	49,584.97	12,885.89	52,784.86	6,697.67	5,062.52

Net loss of Government in two years and ten months to April 24, 1885, $103,493.53.

Fiscal year.	Commissions paid by Government.	Interest paid by Government.	Loss of Government from discount on drafts.	Interest received by Government.	Gain from premium on drafts.
From April 24, 1885, to June 30, 1886	7,764.60	565.30	7,538.70	3,377.85	8,848.88
For year ending June 30, 1887	7,245.93	54.83	5,893.24	3,289.78	10,008.27
For year ending June 30, 1888	5,742.56	7.20	5,121.54	5,383.91	9,728.43
Total	20,753.09	627.33	18,553.48	12,051.54	28,585.58

Net gain from same sources in the three years ending June 30, 1888, $703.22.

NAVAL PROGRESS DURING THE YEAR.

The necessity for increased numbers of fast protected cruisers, whether for purposes of protecting or destroying commerce, or for service with a fleet as scouts, has been emphasized during the naval maneuvers of the year, and is fully recognized by all naval powers.

The fastest, largest, and most powerful protected cruisers yet laid down are the *Blake* and *Blenheim* (English), of 9,000 tons displacement, 20,000 indicated horse-power, trial speed 22 knots, and continuous sea-speed 20 knots, with a coal supply sufficient to steam 3,000 miles at that speed. The armaments* of these vessels will consist of two 9.2-inch B. L. and ten 6-inch R. F. G. The vessels have heavy protective decks, ranging from 4 to 6 inches in maximum thickness.

The fastest protected cruiser built during the year is the *Piemonte.* This vessel has a displacement somewhat over 2,500 tons, carries six 6-inch B. L. and six 36-pounder R. F. G.,* has a protective deck of 3½ inches maximum thickness, and is expected to develop nearly 12,000 indicated horse-power and 21½ knots speed. The *Piemonte* has been bought from Sir William Armstrong & Co. by the Italian Government.

* Rapid-fire guns.

But with the increase of the number of cruisers it has been recognized, in view of the recent introduction of high explosive projectiles, and the increase of power and rapidity of fire of rapid-fire and other guns, that renewed attention must be given to the armored fleet, and the prevailing opinion in England, France, Italy, Germany, and Russia is strongly in favor of additional armored ships to be built at an early date. In these new vessels the armor will be much more widely distributed, and will certainly protect the battery and crew as well as the water line and machinery. The destructiveness of high explosive shell fire against unprotected sides emphasizes the peculiar advantages of the monitor type for coast-defense service.

At no time have the increase and development of navies abroad received greater attention or greater expenditure of money and talent than at present. The following table indicates the number of cruisers built or building, together with the number of armored vessels building and a statement of the annual expenditure for new construction for the navies of England, France, Italy, and Spain:

Number of protected or partially protected cruisers built or building.

Speed.*	England.	France.	Italy.	Spain.
20 knots	5	3	1	3
19 knots	5 + 2†	11	10	0
18 knots	0	0	0	0
17 knots	8	5	0 + 1	0
16 knots and less	0 + 26†	0	0 + 1	0 + 3†
Total	18 + 28†	19	11 + 2†	3 + 3†
Grand total	46	19	13	6

Armored vessels building.

	England.	France.	Italy.	Spain.
19 knots	0	0	0	6
18 knots	1	0	3	0
17 knots	2	4	0	0
16 knots and less	2	0	3	1
Total	5	4	6	7

Expenditure for new construction.

	England.	France.	Italy.	Spain.
Vessels and machinery	$18,346,000	$8,997,000	$6,359,000	‡$41,365,000
Armament	9,068,000	....	270,000	....
Total	27,414,000	....	6,629,000	....

* Speeds given are trial speeds; 10 to 12 per cent. reduction should be made to get corresponding maximum sea speed.
† Indicates partially protected cruisers. This does not include a large number of vessels which have no protection.
‡ To be expended for new construction through nine years.

While speed is still considered as the most important characteristic of the modern cruiser, it is now generally recognized that too much has heretofore been sacrificed to reducing weights of machinery beyond the

limit necessary to secure reliable results. This has been particularly illustrated by the numerous accidents to machinery and boilers in many of the most recent English vessels taking part in the naval maneuvers last summer. An increase of weight and machinery found necessary to properly maintain the desired speed entails either a reduction of ordnance, coal, and other weights, or an increase of displacement in each type; and this latter is the direction in which designs of cruisers (not especially built for police duties in time of peace) are now advancing.

With the question of increasing the fleet that of mobilization and preparation for war receives equal consideration, and all navies are devoting the greatest attention and study not only to the development of their resources for the supply of war material and the fortification of naval bases, but also to the improvement and proper training of their reserves of men. The naval maneuvers of England and France were this year chiefly devoted to testing their capacity for rapid mobilization. The operations of the next naval war will certainly follow immediately upon its declaration, and the nation unprepared will find itself at the mercy of perhaps an inferior foe.

As regards guns the principal developments of the year have been in improved powder and projectiles, in the adoption of rapid-fire guns of about 30 to 45 pounder caliber to replace the 5-inch B. L. rifle, and in the experiments with high-explosive projectiles fired from high-power powder guns.

The greatest improvement in the manufacture of gunpowder has been made in France and Germany, notably in the former, whereby initial velocities have been increased to 2,400 and even 2,600 foot-seconds with reduced powder charge, while the pressures are kept well within the limits required by safety. Such an increase of velocity increases the energy of the projectile of the 6-inch gun about 75 per cent. and increases its penetration from 12 to about 15½ inches in iron.

The Armstrong 4.72-inch rapid-fire gun (generally known as the 36-pounder) now fires a projectile of 45 pounds with a muzzle velocity of 2,073 foot-seconds and a penetration of over 9 inches in iron. This gun has fired ten well-aimed shots in 1 minute 40 seconds. Its weight is now 42 hundredweight. It has been introduced into the English service and forms the principal armament of six cruisers, of 1,600 to 1,900 tons displacement, now building. It has also been introduced into the Italian navy on board the new cruiser *Piemonte*.

An Armstrong 6-inch rapid-fire gun has been completed and is now undergoing trial. It is expected to fire a projectile weighing about 110 pounds, with a powder charge of 40 pounds and chamber pressure of less than 18 tons.

The Hotchkiss 33-pounder has also been recently tried, with satisfactory results, giving a velocity of 2,034 foot-seconds and a penetration of over 8 inches. The rapidity of aimed fire was 10 rounds per minute.

A 6-pounder Driggs-Schroeder gun has been built during the year

by the Driggs Ordnance Company, and is now at the Naval Ordnance Proving Ground for trial.

The steel cast guns received from the Pittsburgh Steel Casting Company, and the Standard Steel Casting Company, of Thurlow, have been machined and finished at the Washington navy-yard and sent to the proving ground, where they will be immediately tried.

While the results of experiments made with melenite shells in France and England have been closely guarded, it seems assured that these projectiles have been safely fired from service guns, and that their bursting effect against the unarmored portions of a vessel is most destructive—against the armored portions the explosive effect is said to be not very great. The manufacture and use of melenite has certainly been greatly developed in France, while the original patent rights have been purchased by an English firm and are now undergoing development in England.

In this country the Hotchkiss Ordnance Company has established works for the manufacture of the Howell torpedo, for which it has purchased the rights.

The Patrick torpedo, spoken of in my last report, has been still further developed, and has on trials before a naval board shown valuable qualties for harbor defense. One of these torpedoes has been purchased by the French navy.

The recent naval maneuvers abroad have shown that torpedo boats must still be regarded as most useful for coast and harbor defense. At the present time England is building two classes of torpedo boats, the first, of 130 feet length, 85 tons displacement, and 22½ tons knots speed, armed with three tubes, giving practically all-around fire, and rapid fire guns; the second, intended for ship's use, of about 11 tons displacement, 17½ knots speed, and armed with one training torpedo tube. France is building four deep-sea torpedo boats, 137 to 147 feet long, 100 to 119 tons displacement, 20¼ to 22¼ knots speed, armed with two to three training torpedo tubes and two revolving cannon; also 41 boats, 115 feet long, 55 tons displacement, armed with two tubes and two revolving cannon. Some of these boats carry the spar torpedo. In the new English and in all French torpedo boats powder is used for discharging the torpedoes. Italy is building 30 boats, 127 feet long, 85 tons displacement, armed with two torpedo tubes and two revolving cannon; also two smaller boats, 101 feet long, and 84 tons displacement. Germany is now building 19 new boats, 121 feet long, 83 tons displacement; armanent, two bow tubes and two revolving cannon.

The French Navy Department is now giving its attention to a new type of submarine boat, of 30 tons displacement, and it is reported that the Germans are experimenting with one of the Nordenfelt type. The Spaniards also have recently launched at one of their dock-yards a new type of submarine boat, of 87 tons displacement. No submarine boat yet tried can be considered as satisfactory.

WAR VESSELS IN COMMISSION.

The North Atlantic Squadron continues under the command of Rear-Admiral Stephen B. Luce, and at present consists of the following-named ships: *Pensacola*, *Ossipee*, *Galena*, and *Yantic*. The *Richmond*, *Atlanta*, and *Dolphin* have been detached from the squadron since my last report and the *Pensacola* added thereto. The *Dolphin* has been assigned to duty in the Pacific Squadron, and the *Richmond* and *Atlanta* are now at the navy-yard, New York, preparing for service on foreign stations. The *Richmond*, *Ossipee*, *Atlanta*, *Dolphin*, and *Yantic* made the usual cruise to the West Indies last winter, and subsequently the entire squadron rendezvoused at Pensacola, Fla., and Port Royal, S. C., for fleet drills and exercises ashore and afloat. The vessels of the squadron afterwards met in Hampton Roads and exercised in squadron tactics during the passage from the capes of Virginia to New York. During the exercises above mentioned, much valuable experience was gained by both officers and men. In August last the *Ossipee*, *Galena*, and *Yantic* assembled at Newport for duty in connection with the course of instruction at the Naval War College. The *Ossipee* and *Yantic* afterwards made a cruise to the fishing grounds in and about the Gulf of St. Lawrence to protect and look after the interests of American fishermen, and the *Galena*, at the request of the Department of State, was sent to Port-au-Prince, Hayti, for the protection of American interests there during the political disturbances in that country.

The *Pensacola* and *Ossipee* are now at the navy-yard, Norfolk, Va., and the *Galena* and *Yantic* at the navy-yard, New York, preparing for sea.

The South Atlantic Squadron is now under the command of Acting Rear-Admiral James H. Gillis, who succeeded Rear Admiral Daniel L. Braine at Rio de Janeiro Oct. 23, 1888. The vessels on this station are the *Swatara*, *Tallapoosa*, and *Alliance*, the first-named vessel having joined the squadron in October last. The *Lancaster* was detached from the squadron in January last and sent to the European station as the flag-ship of Acting Rear-Admiral James A. Greer. The vessels of the squadron have cruised during the year in the waters of Brazil, Uruguay, the Argentine Republic, and Patagonia.

The Asiatic Squadron remains under the command of Rear-Admiral Ralph Chandler. The vessels composing it are the *Omaha*, *Marion*, *Essex*, *Monocacy*, and *Palos*. The *Omaha* and *Marion*, after receiving new officers and men at Panama, returned to their station, having visited en route the principal ports in Central America and Mexico, and Honolulu, Sandwich Islands.

Owing to the continued unsettled condition of affairs in Korea, a part of the force on the station has been kept during the year constantly in Korean waters. In June last an outbreak of the populace in Seoul was threatened, and at the request of our minister an armed force of twenty-

five seamen and marines from the U. S. S. *Essex*, under the command of Lieut. C. D. Galloway, was landed and marched twenty-five miles to that city to protect American residents, and withdrawn a few days later, upon affairs becoming again pacific.

The *Brooklyn* and *Juniata* have been detached from the squadron and ordered to the United States; the former via Honolulu and Cape Horn, and the latter by way of the Suez Canal and Mediterranean Sea. The *Juniata* joined the squadron from the Pacific in March last.

The Pacific squadron continues under the command of Rear-Admiral L. A. Kimberly and consists of the *Trenton*, *Vandalia*, *Mohican*, *Adams*, *Alert*, *Nipsic*, *Dolphin*, *Pinta*, and store-ship *Monongahela*. The *Trenton*, *Nipsic*, and *Dolphin* have joined the squadron during the past year and the *Iroquois* and *Juniata* have left it. The former, needing extensive repairs, was sent to the navy-yard, Mare Island, California, and in March last was put out of commission, and the latter ordered to the Asiatic station.

Vessels of the squadron have visited during the year the principal ports on the west coast of Mexico and Central and South America, but on account of political disturbances in the Hawaiian and Samoan Islands and in Peru, almost the entire force on the station has been kept constantly in the waters of those countries for the protection of the lives and property of our citizens.

The *Mohican*, having been over three years in commission, has received new officers and men and is now at the Mare Island yard refitting for service. The *Monongahela* is also there undergoing repairs, and when they are completed will receive stores and supplies for the Pacific squadron and return to her station. The *Pinta* is still employed in Alaskan waters.

The European Squadron is still under the command of Acting Rear-Admiral James A. Greer. The force on this station now consists of the *Lancaster*, *Quinnebaug*, *and Enterprise*. The *Pensacola* (flag-ship) was detached from the squadron in December last and the *Lancaster* sent from the South Atlantic station to take her place. The *Enterprise* has also been added to the squadron during the past year. The vessels of this squadron have been actively employed during the year in cruising in the Mediterranean and along the west coast of Europe, including the North and Baltic Seas.

The Training Squadron.—The *Portsmouth* was the only vessel of the Training Squadron that made the cruise to the West Indies during the past winter. The other ships, the *Saratoga* and *Jamestown*, after the completion of the temporary repairs put upon them during the winter at the Norfolk yard, were employed in cruising in Chesapeake Bay and adjacent waters. All three of these vessels needing a thorough overhauling to put them in an efficient condition, have recently been put out of commission—the *Portsmouth* and *Saratoga* at the navy-yard, Portsmouth, N. H., and the *Jamestown* at the navy-yard, Norfolk. The

apprentices attached to these ships have been transferred to the general service and to the *Constellation*, and that ship is now making the winter cruise to the West Indies. The *Jamestown* and *Portsmouth* are to be refitted and repaired for service in the Training Squadron and the *Saratoga* turned over to the State of Pennsylvania to be used as a school-ship for boys.

SPECIAL AND DETACHED SERVICE.

The *Despatch*, *Ranger*, and *Michigan* continue on detached service, the same as last year.

The *Boston* was recently sent to Livingston, Guatemala, to inquire into an alleged case of gross maltreatment of an American citizen by the military authorities of that place, and proceeded thence to Haytien waters for the protection of our interests there. She returned to New York on the 24th ultimo.

The *Thetis* has been employed during the past year on special service in the North Pacific. She has been actively engaged in visiting the principal settlements on the north and west coasts of Alaska, and has rendered valuable services to our whaling fleet in the Arctic and to numerous destitute miners in Alaska. Through the exertion of her commanding officer, the wrecked American schooner *Jane Gray*, abandoned in the Arctic, was floated and repaired sufficiently to be sent to San Francisco, where she was turned over to her owners, the officers and men of the *Thetis* generously waiving all claims for salvage.

The *Kearsarge* was put in commission at the navy-yard, Portsmouth, N. H., on the 2d of November, and sailed from that yard for Hampton Roads, Va., on the 10th of that month. She will shortly sail for Montevideo with relief officers and men for the *Tallapoosa*, and after receiving those now on board that vessel will again return to the United States.

The iron-clads stationed for a number of years at City Point, Va., have recently been moved up the James River to a point about three miles below the city of Richmond.

APPROPRIATIONS AND EXPENDITURES, 1888, FOR THE CURRENT EXPENSES OF THE NAVY AND MARINE CORPS.

Amount of appropriations for the fiscal year 1888, including transfer of $43,691.25 by appropriation warrant from "Steel cruisers, Construction and Repair," to re-imburse "Construction and Repair, 1888"	$13,089,813.04
Drawn by requisition to June 30, 1888	10,797,547.94
Leaving a balance, July 1, 1888, of	2,292,265.10
Due general account of advances to June 30, 1888	1,282,842.49
	1,009,422.61
In the hands of disbursing officers June 30, 1888	212,942.37
Actual balance unexpended, July 1, 1888	1,222,364.98

Amount drawn by requisition in August, September, and October, 1888	$1,250,889.86	
Refunded during same period	144,878.61	
		$1,106,011.25
		116,353.73
In hands of disbursing officers, October 31, 1888		22,489.50
Balance available November 1, 1888, (which will be further reduced by outstanding liabilities)		138,843.23

The following table exhibits the appropriations, expenditures, and balances under general heads, the balances being those which were undrawn on June 30 for the fiscal year 1888:

Heads of appropriation.	Appropriations for fiscal year ending June 30, 1888.	Amount drawn during fiscal year ending June 30, 1888.	Balances undrawn June 30, 1888.
Pay of the Navy	$7,000,000.00	$5,573,718.82	$1,426,281.18
Pay, miscellaneous	205,000.00	199,964.75	5,035.25
Contingent, Navy	7,000.00	1,873.49	5,126.51
Pay of the Marine Corps	651,662.88	552,747.56	98,915.32
Quartermaster's department of the Marine Corps	225,628.62	221,447.56	4,181.06
Naval Academy	203,830.45	183,868.11	19,962.34
Navigation and navigation supplies	83,500.00	73,395.18	10,104.82
Ordnance and ordnance stores	126,400.00	101,763.68	24,636.32
Repairs, ordnance	15,000.00	13,859.66	1,140.34
Torpedo Corps	57,800.00	49,009.78	8,790.22
Equipment of vessels	625,000.00	491,100.19	133,899.81
Transportation and recruiting, equipment and recruiting	25,000.00	24,399.87	600.13
Naval Training Station, Coaster's Harbor Island, R. I.	14,000.00	10,871.28	3,128.72
Maintenance, yards and docks	170,000.00	154,969.42	15,030.58
Repairs and preservation at navy-yards	450,000.00	408,693.64	41,306.36
Naval Asylum, Philadelphia, Pa	63,167.00	43,813.78	19,353.22
Medical Department, medicine and surgery	57,500.00	50,439.18	7,060.82
Naval Hospital fund	30,000.00	29,999.79	.21
Repairs, medicine and surgery	20,000.00	19,259.60	740.40
Provisions, Navy	1,121,000.00	852,367.10	268,632.90
Construction and repair	943,691.25	831,439.22	112,252.03
Steam machinery	675,000.00	616,474.98	58,525.02
Contingent (bureaus)	120,500.00	97,949.94	22,550.06
Civil establishment at yards and stations	199,132.84	194,121.36	5,011.48
	13,089,813.04	10,797,547.94	2,292,265.10
Deduct amount due general account of advances June 30, 1888			1,282,842.49
			1,009,422.61
In the hands of disbursing officers June 30, 1888			212,942.37
			1,222,364.98

Although, as above shown, there was an available balance of $138,843.23 of the appropriations of 1888 for current expenses, that balance is liable to reduction under various heads of minor appropriations, by the payment of outstanding liabilities; and while it appears that the expenditures were kept clearly within the bounds of the appropriations, so far as it was within the power of the Secretary of the Navy to control them, a deficiency appropriation will be required under "Pay of the Navy, 1888," in consequence of the increase of the pay of officers of the Navy under recent decisions of the Supreme Court.

There is also a small deficiency under "Pay, miscellaneous, 1888." The expenditures under this head of appropriation can not always be controlled and kept within the amount specifically appropriated, as from

it are paid all traveling expenses of officers or others on public duty, and the travel performed is dependent upon the necessities and requirements of the service.

Of the amount appropriated for the current expenses of the present fiscal year, there has been drawn from the Treasury, after deducting sums refunded from July 1 to October 31, 1888, $3,376,503.79.

ESTIMATES AND APPROPRIATIONS, 1889 and 1890.

The estimates for the Navy and Marine Corps for the current fiscal year amounted to $23,003,624.13; those for the next fiscal year amount to $26,767,677.74, a difference of $3,764,053.61.

Summary of estimates for 1890 for the Navy and Marine Corps.

Secretary's office: Pay of the Navy, pay miscellaneous, and contingent, Navy	$7,773,779.00
Bureau of Yards and Docks	644,620.60
Bureau of Equipment and Recruiting	791,525.00
Bureau of Navigation	175,000.00
Bureau of Ordnance	245,980.00
Bureau of Construction and Repair	919,972.50
Bureau of Steam Engineering	813,900.00
Bureau of Provisions and Clothing	1,336,160.03
Bureau of Medicine and Surgery	122,500.00
Naval Academy	188,813.45
Marine Corps	921,828.18
For ordinary objects of expenditure	13,934,078.76
Increase of the Navy (construction and armament)	9,717,000.00
Improvements of all kinds at yards and stations	2,214,248.98
For new Naval Observatory	240,000.00
For other special objects	662,350.00
Total	26,767,677.74

The appropriations for the current fiscal year amount to $19,942,481.05, being $6,825,196.69 less than the estimates for the next fiscal year.

This increase of the estimates over the appropriations is shown, by bureaus, and explained as follows:

INCREASE BY BUREAUS.

Secretary's office	$469,375.00
Bureau of Construction and Repair	414,810.49
Bureau of Steam Engineering	2,085,881.37
Bureau of Provisions and Clothing	172,872.47
Bureau of Equipment and Recruiting	96,000.00
Bureau of Medicine and Surgery	35,000.00
Bureau of Yards and Docks	102,765.41
Bureau of Navigation	326,900.00
Bureau of Ordnance	2,972,905.00
Marine Corps	4,886.95
Naval Academy	143,800.00
Total	6,825,196.69

EXPLANATION OF DIFFERENCES.

DIFFERENCE IN SECRETARY'S OFFICE.

Increased pay to officers under decisions of the Supreme Court........	$100,000.00
Increased pay to petty officers and seamen under new classification and rates proposed........	300,000.00
Increase in bounty to additional number re-enlisting under honorable discharge........	9,000.00
Increase on account of additional number of cadets under instruction..	30,500.00
Increase on account of increase in clerks of vessels, etc........	6,500.00
Increase on account of different assignment of officers to duty........	40,096.00
Increase in pay, miscellaneous........	10,000.00
	496,096.00
Decrease in pay of retired officers........	26,721.00
	469,375.00

DIFFERENCE IN BUREAU OF CONSTRUCTION AND REPAIR.

Increase:			
Construction and Repair........		$75,000.00	
Increase of the Navy........		540,000.00	
For improving plant, navy-yard, New York.	$110,000		
For improving plant, navy-yard, Norfolk...	50,000		
		160,000.00	
			775,000.00
Decrease:			
Civil establishment........		189.51	
Improving plant, navy-yard, Mare Island........		100,000.00	
Constructing practice ship, Academy........		260,000.00	
			360,189.51
			414,810.49

DIFFERENCE IN BUREAU OF STEAM ENGINEERING.

Increase:		
Steam machinery........	195,000.00	
Improving plant, navy-yard, New York........	155,000.00	
Improving plant, navy-yard, Norfolk........	60,000.00	
Improving plant, navy-yard, Mare Island........	55,000.00	
For experimental purposes........	25,000.00	
For increase of the Navy........	1,600,000.00	
		2,090,000.00
Decrease:		
Civil establishment........		4,118.63
		2,085,881.37

DIFFERENCE IN BUREAU OF PROVISIONS AND CLOTHING.

Increase:		
Provisions........	158,798.50	
Contingent........	10,000.00	
Civil establishment........	4,073.97	
		172,872.47

DIFFERENCE IN BUREAU OF EQUIPMENT AND RECRUITING.

Increase:		
Equipment of vessels	$75,000.00	
Contingent	5,000.00	
Training station, Coasters Harbor Island	16,000.00	
		$96,000.00

DIFFERENCE IN BUREAU OF MEDICINE AND SURGERY.

Increase:		
Sick quarters, Portsmouth, N. H	35,000.00	
Residence for medical director, Mare Island	20,000.00	
		55,000.00
Decrease, sea wall, Portsmouth, Va		20,000.00
		35,000.00

DIFFERENCE IN BUREAU OF YARDS AND DOCKS.

Increase:		
General maintenance	35,000.00	
Contingent	20,000.00	
Civil establishment	2,914.90	
Improvement at yards	109,092.51	
Officers' quarters, Key West	8,000.00	
		175,007.41
Decrease:		
Naval Asylum	2,242.00	
Repairs and preservation	25,000.00	
Commission on location of yards	15,000.00	
Adjustable stern-dock	30,000.00	
		72,242.00
		102,765.41

DIFFERENCE IN BUREAU OF NAVIGATION.

Increase:		
Navigation supplies	40,000.00	
Electric-lighting plant for ships	66,200.00	
Ocean surveys	15,000.00	
Publishing charts of Mexican and other coasts	5,000.00	
Charts of China, Japan, etc	10,000.00	
Civil establishment	700.00	
New Naval Observatory	190,000.00	
		326,900.00

DIFFERENCE IN RUREAU OF ORDNANCE.

Increase:		
Armor and armament	2,077,000.00	
Contingent	5,000.00	
Civil establishment	455.00	
Wharf, Craney Island, near Norfolk	5,000.00	
Main and secondary batteries	222,500.00	
General armament	142,650.00	
Lighter, torpedo station	8,000.00	
Torpedo-boat house, Newport	5,000.00	
Torpedo railway, Newport	5,000.00	
Gun plant, navy-yard, Washington	625,000.00	
		3,095,605 00

Decrease:		
Ammunition for guns of the *Vesuvius*	$12,000.00	
Modern guns for cadets	55,000.00	
Modern guns for apprentices	50,000.00	
Torpedo Corps	5,700.00	
		$122,700.00
		2,972,905.00

DIFFERENCE IN MARINE CORPS.

Increase, Pay Department	12,502.77	
Decrease, Quartermaster's Department	7,615.82	
		4,886.95

DIFFERENCE IN NAVAL ACADEMY.

Increase:		
Purchase of land	108,000.00	
Furniture for cadets' quarters	10,000.00	
Lighting academy by electricity	55,000.00	
		173,000.00
Decrease, repairs		29,200.00
		143,800.00

ESTIMATES FOR 1890 INCREASED OVER APPROPRIATIONS OF 1889.

Civil establishment, yards and stations	$3,835.73
Contingent, bureaus	40,000.00
Increase of the Navy, construction	2,140,000.00
Increase of the Navy, armor and armament	2,077,000.00
New Naval Observatory, Washington	190,000.00
Pay of the Navy	459,375.00
Pay miscellaneous	10,000.00
Steam machinery	195,000.00
Construction and repair of vessels	75,000.00
Provisions for the Navy	158,798.50
Equipment of vessels	75,000.00
Coaster's Harbor Island	16,000.00
General maintenance, yards and stations	35,000.00
Improvement of yards and stations	109,092.51
Navigation and navigation supplies	40,000.00
Surveys and charts	20,000.00
Marine Corps	4,886.95
Total	5,648,988.69

NEW OBJECTS.

FOR THE BUREAU OF ORDNANCE.

Wharf, Craney Island, near Norfolk	$5,000.00
House for torpedo-boat *Stiletto*, torpedo station	5,000.00
Marine railway, torpedo station	5,000.00
Lighter, torpedo station	8,000.00
Gun-plant, Washington navy-yard	625,000.00
Main and secondary batteries	222,500.00
General armament	142,650.00

FOR THE BUREAU OF CONSTRUCTION AND REPAIR.

Improving plant, tools, navy-yard, New York	$50,000.00
Experimental tank, resistance of ships, New York	60,000.00
Improving plant, navy-yard, Norfolk	50,000.00

FOR THE BUREAU OF STEAM ENGINEERING.

Improving plant, navy-yard, New York	155,000.00
Improving plant, navy-yard, Norfolk	60,000.00
Improving plant, tools, navy-yard, Mare Island	55,000.00
Experimental purposes	25,000.00

FOR THE BUREAU OF MEDICINE AND SURGERY.

Sick quarters, Portsmouth, N. H	35,000.00
Medical director's residence, Mare Island	20,000.00

FOR THE BUREAU OF NAVIGATION.

Charts, Japan and China and Pacific islands	10,000.00
Electric lighting plant for vessels	66,200.00

FOR THE BUREAU OF YARDS AND DOCKS.

Officers' quarters, Key West	8,000.00

FOR THE NAVAL ACADEMY.

Purchase of land	108,000.00
Furniture for cadets' quarters	10,000.00
Lighting Academy by electricity	55,000.00
	1,780,350.00

DECREASE IN ESTIMATES FOR 1890, COMPARED WITH APPROPRIATIONS 1889.

Repairs, etc., Naval Academy	29,200.00
Repairs and preservation of yards	25,000.00
Naval Asylum	2,242.00
Torpedo corps	5,700.00
	62,142.00

APPROPRIATIONS MADE FOR 1889, NOT ESTIMATED FOR IN 1890.

Improvement of plant, Mare Island (Construction and Repair)	100,000.00
Practice ship, Naval Academy	260,000.00
Sea-wall, hospital, Portsmouth, Va	20,000.00
Selecting locations for yards	15,000.00
Adjustable stern-dock	30,000.00
Ammunition for guns of the *Vesuvius*	12,000.00
Modern arms for cadets	55,000.00
Modern arms for apprentices	50,000.00
	542,000.00

RECAPITULATION.

Appropriations increased		5,648,988.69
New objects asked for		1,780,350.00
		7,429,338.69
Decrease in estimates	$62,142.00	
Appropriations for 1889 not asked for 1890	542,000.00	
		604,142.00
Actual increase in estimates for 1890 over appropriations for)		6,825,1

SALES OF GOVERNMENT PROPERTY AND VESSELS.

As will be seen by the detailed statement, page 532 of the Appendix, the total amount deposited in the Treasury from November 1, 1887, to November 1, 1888, as receipts from sales of Government property pertaining to the Navy, was $337,095.23, which sum included also receipts from the sale of articles to other Departments of the Government, rents, interest, and premiums on exchange. The amount received from the sale of old materials condemned by Statutory Board, under the provisions of the act of August 5, 1882, as unserviceable for any purpose connected with the Navy, was $253,569.13, of which $157,640.31 were covered into the Treasury as "miscellaneous receipts," and $95,928.82 carried to the credit of proper appropriations, in pursuance of law.

Two condemned vessels have been sold within the past year, the *New York*, unfinished and partly broken up on the stocks at the navy-yard, Brooklyn, and the *Antietam*, embedded in the mud at League Island, with the tide flowing through her.

It was necessary to clear the ship-house of the *New York*, and she was sold May 31, 1888, to the highest bidder, C. H. Gregory, of Great Neck, L. I., for $10, full security having been given that she would be broken up and removed and the ship-house left in clean condition. The purchaser has about fulfilled his contract. The *Antietam* could no longer be used with safety to health, and was sold September 8, 1888, at auction, to the highest bidder, C. H. Gregory, of Thomaston, L. I., for $6,700, and ample security given by him that she would be removed and the channel cleared of all débris. Both of these vessels were condemned by Statutory Board, and due public notice given, by advertisement, of the time they would be sold. The proceeds of these sales, less the auctioneers' commissions, were covered into the Treasury by the disbursing officers who received the payments.

As stated in my last annual report, the balance on deposit at that time with the Treasurer of the United States, on account of proceeds from the sale of old vessels, subject to my check, was $17,384.87. There has since been paid out for advertising such sales $444.40, and turned into the Treasury as "miscellaneous receipts" $16,000, leaving a balance on deposit and due to the United States of $940.47, to be held i nreserve, for the present, for the payment of any outstanding advertising bills, or for use under the provision of the act of March 3, 1883, which provides for the disposition of vessels condemned as unfit for further service in the Navy. A copy of the account current rendered, with the necessary vouchers, to the Fourth Auditor of the Treasury, will be found in the Appendix, page 539.

REPORT OF THE ADMIRAL.

The report of the Admiral of the Navy, dated July 18, 1888, presents interesting observations in regard to the apprentice system. He ad-

vocates the employment of sailing vessels for practice ships, and an enlistment for ten years, with the understanding that all the ratings of petty officer shall be open to apprentices. He deprecates too high a standard for admission and the holding out of forlorn hopes of promotion, as thereby recruits are obtained from too high a station to insure their remaining in the service as enlisted men. In reference to torpedoes the Admiral does not favor the Whitehead system, and cites the success of net defenses. He speaks well of the Berdan ram-torpedo, the Ericsson submarine gun, and the Graydon shell. He also advocates the continuance of the War College as a most valuable factor in preparing officers for war service. As senior officer of the Board of Inspection he reports favorably on the condition and general efficiency of the ships inspected before going to sea and on their return.

BUREAU OF YARDS AND DOCKS.

The Chief of the Bureau of Yards and Docks, Commodore D. B. Harmony, gives a detailed report of the expenditures and improvements at the navy-yards and naval stations during the past year, and submits estimates for the amounts required during the coming year for the maintenance, preservation, repair, and improvement of the yards. Among these recommendations may be noted extension of the water frontage at several of the yards; the introduction of electric plants for lighting; the repair and improvement of docking facilities and public buildings, and the extension of the railroad systems. Commodore Harmony also calls attention to the advisability of gradually extending and constructing permanent water fronts of stone or concrete at our principal navy-yards. The present water frontage is insufficient, and, being generally of timber, is subject to decay and the ravages of the teredo.

BUREAU OF ORDNANCE.

The report of the Chief of the Bureau of Ordnance, Commodore Montgomery Sicard, contains a summary of the work of that important Bureau during the year.

The work of constructing the ordnance for the new navy is progressing slowly but surely. Exact results are required and much work has to be performed in experiment before they can be obtained.

The results, however, prove that we are not behind any nation in our power to adapt and design, and that our manufacturing conveniences are rapidly improving.

He reports the adoption of a new model for 6, 8, and 10 inch guns, which, without increasing the weight, adds to the strength of the gun.

Good results have been obtained with American brown powder in 6-inch guns, and he expects soon to have satisfactory results with that for higher calibers.

He says that good results have attended the tests of the new square lozenge black powder in rapid-fire guns.

He states the necessity of a new form of powder which is being used abroad with wonderful results, but of which we do not know the process of manufacture.

Good results have been obtained at last with cast-steel projectiles.

It has been possible to obtain two armor-piercing shells during the last year; if these give good results on trial, others can be procured similar to them.

Fair progress has been made towards obtaining good forms of percussion fuses and electrical primers.

The work on gun-carriages has progressed considerably, and thirteen sets of castings for 6-inch central pivot carriages have passed the balistic tests.

The *Chicago's* central pivot 8-inch carriages are completed. Steel deck circles and clips have been fitted to the *Atlanta* and *Boston*, and have given excellent results.

The first of the 10-inch turret carriages for the *Miantonomoh* has given good results at the Ordnance Proving Ground.

The Hotchkiss Ordnance Company is filling a large order for its guns, which are being constructed in this country after considerable difficulty in obtaining suitable material.

Several new forms of mounts for secondary battery guns have been devised by Lieut. F. F. Fletcher, and have given good results.

Fairly good results have been obtained with several marine guns submitted for trial.

A new revolver, in the designing of which Lieut. W. W. Kimball has been of great service, has been adopted, and 5,000 ordered from the Colt's Arms Company. Only a few Lee magazine rifles, to meet pressing wants, have been ordered, as the Bureau believes that a reduction from a 45 caliber to a smaller one will soon take place.

The armaments of the *Boston*, *Atlanta*, and *Chicago* are completed, and those of the *Baltimore* and *Charleston* are well in hand.

The Bethlehem Company has a portion of its machinery completed, and will soon begin to deliver forgings for the smaller guns. It has not yet erected a hammer for the manufacture of armor plates.

The erection of the buildings and machinery of the new gun factory is advancing slowly. Great difficulty, owing to quicksand, was experienced in excavating for a shrinking pit, and a greater expense incurred than was expected. The difficulty is, however, now surmounted, and the work is proceeding satisfactorily.

The Department's advertisement for proposals for 16-inch boring and turning lathes and 16-inch jacket lathes did not produce satisfactory proposals; therefore new advertisements are to be issued.

The Bureau recommends the armament of some of the better class of old ships with modern guns. These guns will serve for future new

ships. In the same connection it suggests the purchase of a few rapid-fire guns; also that of cadet magazine rifles for use in the instruction of cadets at the Naval Academy.

The work performed at the Naval Ordnance Proving Grounds, under the superintendence of Lieut. Austin M. Knight, is highly commended. The difficulties attending the firing of shotted guns over water which is continually traversed by vessels necessitates the selection of another ocality, and such a change has received due consideration and bids fair to be solved satisfactorily. The money already appropriated for the purchase of a new ground has not yet been used.

The Torpedo Board, provided for in the act of Congress, approved August 3, 1886, is still in session. Three finished systems of torpedoes have been submitted for trial.

On August 4, 1888, the Department decided to order 30 Howell torpedoes, with the right to extend the order to 50, from the Hotchkiss Ordnance Company.

The Bureau reports that the instruction of enlisted men in torpedo work and ordnance material has proceeded successfully. A course of gunnery instruction will soon be initiated at the torpedo station, and it is hoped, in view of the increased need of seamen gunners, to increase the number of men under instruction.

In answer to the Department's advertisement in November last for proposals for a submarine boat, two designs were submitted, but as neither contained any guaranty of performance of the functions required, they were rejected.

In accordance with the act of Congress approved August 3, 1886, and in answer to the advertisement of the Department, two proposals were received for the construction of a steel sea-going torpedo boat. That of the Herreshoff Manufacturing Company was accepted, and the boat is now in process of construction.

In accordance with the act of Congress approved March 3, 1887, the steamer *Stiletto* was purchased from the Herreshoff Manufacturing Company and has proved of great service for exercising the officers and men at the Torpedo Station.

The 8-inch pneumatic gun carriage and apparatus for working the 10-inch guns of the *Terror*, contracted for with the Pneumatic Gun Carriage Company, are now being constructed by the South Boston Iron Company.

Pursuant to an act of Congress approved March 3, 1887, two cast-steel, high-power 6-inch guns have been furnished by contract; one is of Bessemer steel, constructed by the Pittsburgh Steel Casting Company, the other of open-hearth steel, furnished by the Standard Steel Casting Company. No proposals were received for a crucible-steel gun. The guns received have been finished and will soon be tested.

The Bureau reports important progress at the Torpedo Station, and an improvement in the buildings, wharves, and apparatus. A further

appropriation will probably be required to complete the extension of the sea-wall, as authorized by Congress.

The encouragement of private manufacturers, whose works are located back from the Atlantic and Pacific sea-board, to manufacture gun-cotton is recommended, as such increased production would be of great service in case of war.

Good results have been obtained in using gun-cotton as bursting charges in the shells of ordinary guns up to 80-pounders, and there seems to be no reason why it should not be used in the large calibers if a suitable fuze can be produced.

A service electrical lamp for submarine work has been completed and is now issued to ships. Arrangements have been made to secure torpedo search-light apparatus of American manufacture. This is an important step.

Important researches have been made in the chemical laboratory, including the investigation of explosives and metals, and the effect of the detonation of determined amounts of explosives.

The instruction of officers in torpedo and similar subjects has progressed, and several new features have been introduced.

BUREAU OF EQUIPMENT AND RECRUITING.

In the report of Commodore W. S. Schley, of the Bureau of Equipment and Recruiting, will be found a statement of the supplies purchased and manufactured by the Bureau during the past year. The working of the equipment department established at the Boston yard has given excellent and economical results, notwithstanding that much of the machinery taken over at the time of the transfer was found to be defective and in great need of repair.

The Bureau reports that it is substituting a new galley made at the Boston yard for the old Young's galley formerly used. This change was necessitated by the improved Navy ration, which requires better cooking facilities.

A statement is made of the number of men in the service, the number enlisted, discharged, deserted, died, re-enlisted, and employed on special service.

A recommendation is made, in view of the fact that the number of continuous service men, although large, is not as large as it should be, that a board be convened to formulate a uniform scale of punishments and classification of offenses, the present uneven way of administering justice being claimed to be one of the great causes which prevent re-enlistments.

The instruction of seamen at Washington and the torpedo station is commended.

In regard to the apprentice establishment, the Bureau reports fair results. The want of proper training-ships has been a great drawback,

and the construction of new bark-rigged vessels of modern type is again recommended for use as practice vessels.

New tables of allowance for the new types of ship have been made and have been sent to the equipment depot.

Commodore Schley concludes his report with some valuable recommendations in regard to the improvement of the men's messes, the in crease of the pay of certain grades of petty officers and other enlisted men in order that the service may get a better class of men now required by the improvements in material; the extension of the retirement and citizenship laws passed for the Army and Marine Corps to the enlisted men of the Navy; and that power be given to naval officers to administer the oath of allegiance to recruits as is now done by officers of the Army.

BUREAU OF STEAM-ENGINEERING.

The report of Engineer-in-Chief George W. Melville, Chief of the Bureau of Steam-Engineering, gives the amounts expended in the purchase of material, purchase and construction of steam-machinery, with estimates for the fiscal year 1890.

Under the head of "General Operations" a résumé of the work performed under the bureau is given, which includes the construction of new machinery and repairs to that already in use.

Under the head of "Machinery under Construction" is given the present state of advancement in the designing and constructing of machinery for the *Newark* (cruiser No. 1), *Philadelphia* (cruiser No. 4), *Charleston* (cruiser No. 2), *San Francisco* (cruiser No. 5), *Baltimore* (cruiser No. 3), *Concord* (gun-boat No. 3), *Bennington* (gun-boat No. 4), *Yorktown* (gun-boat No. 1), *Petrel* (gun-boat No. 2), *Vesuvius*, and the monitors *Monadnock*, *Terror*, and *Amphitrite*.

Recommendations are renewed to build large proving and testing machines at the New York and Mare Island navy-yards, and to establish central steam and electric generating plants in the navy-yards, which should supply all of the points where steam-power and light is required.

A synopsis of the work done at the various yards is given, together with a statement of the condition of the various plants of machinery and suggestions in regard to minor changes.

Under the head of "Personnel of the Engineer Corps," the Engineer-in-Chief calls attention to the number of engineers and machinists in our own and in foreign services, and asks for the appointment of an assistant chief of Bureau. He strongly recommends the establishment of a practice-ship for the men of the engine-room force, especially for those of the rating of water-tender, the latter having new and very important duties to perform in running the machinery of the new-type ships. He also recommends that all vessels fitted for forced draught should be run under forced draught until the engine-room force has be-

come entirely expert in developing the highest powers of the ship. This would of course slightly increase the expenditure of fuel for a time, but without it the great extra cost of perfected boilers and machinery would be lost.

In regard to the rating of men as machinists, he recommends a more thorough examination.

The chief of the Bureau argues against the retention of vessels on active service, without thorough overhauling, for a period of more than three years, because by so doing the engines are entirely exhausted, whereas otherwise slight repairs render them thoroughly efficient for another cruise.

The chief of Bureau reports that, being convinced of the important reduction in weight which the introduction of coil boilers would ensure, the Department issued a circular inviting manufacturers to submit plans of a boiler adopted for use in an armored coast-defense vessel. In answer to this circular twenty-three firms applied for and were furnished with information, and nine submitted designs. Owing to the pressure of other business no decision has yet been reached as to which of these boilers will be tested.

During the past year the following important tests have been made: A Belleville coil-boiler on board Mr. J. M. Forbes's yacht *Shearwater*, giving very good results. A new style of boiler made by the Herreschoff Manufacturing Company, so designed as to necessitate less intelligent handling than those of their design now in use in the service; the results were very satisfactory. A boiler using naphtha as a fuel, built by the Hohenstein Manufacturing Company; the results were interesting, giving additional data on the evaporative powers of naphtha.

The new boilers of the *Swatara* were tested under forced draught with and without circulating plates; the results proved the value of the use of circulating plates.

A very interesting test of a device for burning petroleum was made on a locomotive fitted up by the Petroleum Fuel and Motor Company. The apparatus was very successful, and the evaporative results are, it is said, the best on record.

A very small oscillating engine, 5 by 7 inches and 10 inches high, designed for driving blowers and centrifugal engines on steam-launches, was tested. The highest speed was about 2,100 revolutions per minute; a similar engine has reached 3,200 revolutions per minute.

A comparative test was made of the two systems of steam indicators now in use. Both gave good results, and the difference in their performance was very slight.

Excellent results were obtained for "Magnolia metal" on a comparative test with the best anti-friction metal heretofore tested.

The result of tests made with an aluminum bronze furnished by the

Aluminum Bronze Smelting Company, shows the metal to be a valuable one when a non-oxidizable metal of great strength is required. On account of a want of knowledge in handling the casting of large masses of this metal two castings for the propeller of the *Petrel* were condemned owing to the existence of blow-holes. It is to be hoped that better results will be obtained when more experience is gained.

Tests have been made with another valuable material, the bronze made by the Deoxidized Metal Company. The specimens tested with good results were made by order of the Bureau with exactly the same composition as "navy-bronze," but the company claim even better results with their own composition. These tests, with the exception of the *Swatara's* boilers, were made at the expense of the parties submitting the articles, but as officers had to be taken from other duties the chief of the Bureau recommends the establishment of an experimental board of engineers.

Under the caption of "Estimates of Appropriations" required, the chief of Bureau states that every cent estimated for the coming year will be needed, and that he is not entirely satisfied that he should not have asked for more as the appropriations for this Bureau have been decreased every year lately without a corresponding decrease in the necessity for expenditures. He says that he supposes that the Congressional committee is influenced by the fact that there is generally a balance left at the end of the year. There must be either a balance or a deficiency, and it is impossible to regulate matters so that the expenses which are incurred all over the world shall foot up to the exact appropriation. Important work is therefore often neglected in order to be within the appropriated amounts.

The appropriation for the purchase of new tools is strongly recommended as is also that for experimental purposes.

The estimates for the construction of new machinery is based upon the requirements of the new vessels under construction and authorized during the past fiscal year.

BUREAU OF CONSTRUCTION AND REPAIR.

Chief Constructor Theodore D. Wilson, chief of the Bureau of Construction and Repair, shows in his report the work performed and the amount expended by the Bureau during the last fiscal year, together with estimates required for the fiscal year ending June 30, 1890.

He recommends an estimate for a chief draughtsman, such a rating having been allowed for similar work under the Bureau of Steam Engineering for several years.

The immediate construction is strongly recommended of "experimental works," at a cost of $60,000, for use in the determination of the resistance of ships by means of models. The "works" are a most important part of the equipment of the ship-building branch of foreign

naval establishments, and, although expensive, have been introduced largely by private ship-building firms.

For sentimental reasons it is recommended that the *Hartford*, which is likely to be condemned, be repaired. For a sum probably less than that fixed by the Board of Survey she could be made to render valuable service as a cruiser for several years and then still be useful as a receiving ship.

Attention is again called to the condition of the single-turreted monitors; they are a source of considerable expense to the Government without being, in their present condition, of much actual value.

The present tugs, which are now obsolete, expensive, and of but little actual value, should be replaced by six modern tugs of about 200 tons displacement each.

Tables of the vessels of the Navy, with data referring to them, and a statement of the condition of the vessels now building, are appended.

In accordance with the act of Congress of August 3, 1886, two navy-yards will soon be equipped for steel and iron war-ship building of every type and size. The navy-yard at Mare Island is also being fitted with a complete outfit of modern ship-building tools. Mare Island, our only yard on the Pacific coast, is particularly well suited for ship-building purposes.

BUREAU OF PROVISIONS AND CLOTHING.

Paymaster-General James Fulton, Chief of the Bureau of Provisions and Clothing, which, under the late partial reorganization of this Department, has become the purchasing and store-keeping branch for all the bureaus, submits the details of the new organization of his bureau, and gives summaries of the office work performed during the year; also statements of the appropriation "Provisions," "Contingent provisions and clothing," "Clothing," and "Small store" funds, "Sales at auction" and schedules of proposals to furnish naval supplies invited under advertisements and of contracts made for the fiscal year 1888.

By the consolidation under this bureau of all general supplies for the Navy a large amount of work has been devolved upon it. Experience warrants the continuation of the system and has developed improved methods of business.

The chief of the Bureau recommends, in view of the importance of the boards of inspection at the various stations and the amount of work done by them, that they should be furnished with suitable permanent office room and given clerical assistance. The appliances for carrying out the necessary tests and proofs should be furnished the board so that they may be equipped for their work as well as similar persons employed by great mercantile interests.

For the first time in the history of the Navy it has been possible to prepare complete statements by classes of receipts and expenditures of supplies throughout the entire service, and of the total valuation of supplies on hand for issue at all shore stations.

In regard to the purchase of tobacco for the Navy, the Paymaster-General recommends that Congress be requested to repeal the act approved March 3, 1881, entitled "An act to regulate the mode of purchasing tobacco for the United States Navy," and that tobacco be purchased as formerly prescribed by section 3721 Revised Statutes.

Under the act tobacco must be purchased at a fixed time without regard to the actual needs of the service. This requires costly separate advertising; further, the act requires that the lowest bid shall be accepted for furnishing tobacco equal to the United States Navy standard. As there was no standard at the time of the passage of the act, the natural effect of competition has been to lower the standard of an article which is actually paid for by the enlisted men, and should therefore be suited to their taste and of the quality preferred by them. The tobacco purchased should also be so specially prepared as to meet the varied circumstances of naval service.

In regard to the advertisement now required by law previous to the submission of proposals for supplies, he recommends that in view of the improvements in the methods of business due to greater facilities for communication and publication that the time be reduced from four to two weeks, which would be in the interest of economy and quicken delivery of supplies.

On account of a decision of the Acting Attorney-General dated August 2, 1888, the Bureau does not deem it necessary to renew its recommendations submitted in a prior report in regard to the bonds of pay officers.

BUREAU OF NAVIGATION.

Commodore J. G. Walker, Chief of the Bureau of Navigation, submits in his annual report a sketch of the operations of the Bureau during the last year, together with estimates for its support and that of the offices under it for the expenditures which will be necessary for the naval service during the fiscal year ending June 30, 1889.

Included in his report are those of the Superintendent of Compasses, the Naval Inspector of Electric Lighting, the Naval War College, the Hydrographic Office, the Naval Observatory, and the Nautical Almanac Office.

He states that after a six months' competitive trial fourteen chronometers of domestic manufacture have been purchased, and that chronometers of foreign make are no longer purchased. Spy-glasses are hereafter to conform to a standard one at the Naval Observatory. Advance has been made in the construction of naval compasses. The libraries of cruising ships have been enlarged by the addition of modern books. The placing of the entire subject of electric lighting in the hands of an expert inspector has produced excellent results. Ocean surveys have been successfully carried on by several of the smaller vessels of the Navy with satisfactory results. In connection with the

important subject of the destruction of derelicts he recommends the constant employment of a small vessel for that purpose. A party has just started for the purpose of continuing the determination of longitude of important points by telegraphic signals. The present field of labor is in Mexico and Central America.

In regard to the Hydrographic Office the Chief of Bureau strongly recommends the giving of more space for its important work, of use to the whole maritime interests of our country. To meet this necessity a separate building is suggested where all the work can be done more economically, and, besides, storage room may be had for the immensely valuable copper plates for charts, which are very bulky and are now accumulating in great numbers.

In the Nautical Almanac Office the volumes for 1893 and 1894 are in a state of forwardness.

At the Naval Observatory two additional computers are required in order to bring up the important work of the transit circle, which is now falling behind.

The time service has been extended and has given great public satisfaction. Five thousand dollars are asked for, to continue the service properly.

The magnetic observatory work is progressing, and the results will be ready for publication at an early date. Attention is especially called to the proposed charting of the heavens, and the necessity for an adequate appropriation to enable the Observatory to perform its share of this great work is requested.

The Department library, composed entirely of books on technical subjects absolutely necessary for the working of the Department, is greatly hampered by the smallness of the amount allotted to it; an increase from $1,000 to $2,500 is earnestly desired.

The very important work connected with the publication of the Naval War Records has hitherto made slow progress. By the act of July 11, 1888, the first actual impetus was given by Congress, and it is hoped that, in view of the great demand for the records and the danger of losing many important documents which are now in private hands, Congress will be liberal in its allowance for the prosecution of the work.

The Naval War College, now in its fifth year, has done good work in furnishing, in the shape of lectures on technical subjects, the result of the close application of specialists having access to all of the best means of information, to the officers of the Navy, whose time being occupied by their general duties, and who, not having the necessary facilities for reference, are prevented from keeping pace with the advance of the naval art of war. It is earnestly recommended that whatever changes may be made in the administration of the college nothing may be done to interrupt the attainment of its main object, namely, the systematic study by naval officers of the practice and methods of modern war as applied to the special necessities of the United States.

In regard to the establishment of a system of naval reserves, Chief of Bureau asks favorable attention to the subject, which has as an object the supply of a reserve to meet the demands of the country for rapidly manning and increasing its fleet upon the outbreak of war. At present no means exist for providing the fleet with a single trained man beyond the number prescribed by law for the peace establishment. The passage of the Whitthorne bill will do much to remedy this evil.

On July 9, 1888, an act was approved to hold an international marine conference to secure greater safety for life and property at sea. The importance of the conference, for the calling of which Congress has already given authority, can not be overestimated, and early action is suggested, with a view to preparing thoroughly for the proposed de- liberations.

BUREAU OF MEDICINE AND SURGERY.

Surgeon-General John Mills Browne submits, in his report as Chief of the Bureau of Medicine and Surgery, a statistical report of the health of the Navy, together with estimates for the coming fiscal year, and a statement of the condition of the Naval Hospital fund.

He recommends the construction of a small hospital at Portsmouth, N. H., navy-yard, on Seavy's Island, in place of the almost uninhabitable temporary quarters now occupied.

He reports the yellow-fever hospital at Widow's Island, Penobscot Bay, Maine, as now prepared to accommodate fifty patients, with a possible accommodation for a much larger number. The conveniences for exercise and transportation have also been improved.

Improvements have been made and are to be made in the steam-heating apparatus at the Chelsea and Brooklyn hospitals.

The hospitals at Philadelphia, Pensacola, Mare Island, Washington, and Yokohama, Japan, and at the Naval Academy are reported in good condition.

The unoccupied portion of the hospital at Norfolk is in a decayed and dilapidated condition, and would require an expenditure of $32,000 to put it in serviceable condition. An appropriation of $5,000 has been expended in improving the hospital grounds.

The Bureau again calls attention to the great necessity of erecting quarters for the senior medical officer at the Mare Island Hospital. He is now occupying quarters which are needed for other purposes in this very important hospital, second only to that at Brooklyn, and which could be made to save the Government much expense if it could furnish quarters for persons who have now to be transported to the Naval Asylum at Philadelphia.

The Museum of Hygiene is reported to be in flour ing condition, the collection and library increasing : id ing in on not only to students of hygi to interested in sanitary h museum devoted to t

The Surgeon-General reports very discouraging results in filling vacancies in the lowest grade of the Medical Corps; seven of the twelve applicants, to fill eleven places, were found physically disqualified, and only one of the remaining five passed professionally.

A statement is made in regard to the insane patients, belonging to the Navy, treated at the Government hospital at Washington.

NAVAL ACADEMY.

REPORT OF THE SUPERINTENDENT.

Commander W. T. Sampson, U. S. Navy, Superintendent of the Naval Academy, gives in his report a résumé of the results of the examinations during the year, by which it is shown that the percentage of the admissions has been increased from 58 to 64 per cent., and that excellent results have attended the course of instruction.

Greater weight is being given to practical professional qualifications, which will no doubt increase the usefulness of the graduates to the Government.

In treating the subject of the cataloguing of the Naval Academy library, which now contains 29,500 volumes, Commander Sampson makes a most valuable suggestion, which should not fail to strike the attention of Congress. He states that the great labor required in making the catalogues for libraries prevents their ever being as correct and complete as they should be. That each library is going over an immense amount of work which is similarly gone over in others. To obviate this he suggests the preparation of a great catalogue printed on cards, which could be procured for special catalogues, just as the books themselves are.

The superintendent recommends that the enlisted men on duty at the Academy shall be general service instead of special service men, as thereby a better class of men can be obtained, the former being entitled to the advantages of re-enlistment. It is most important that none but the very best men should be brought in contact with the cadets, especially upon their summer practice cruise.

In the estimates for the next fiscal year the following items are submitted, in addition to the usual estimates:

(1) For the purchase of the private property which lies between the portions of the Government land and entirely separates them. Until this property is purchased the 11 acres outside the Academy limits and belonging to the Academy can not be inclosed, improved, or made use of in any way beneficial to the Academy. This has been previously recommended, the principal reason for so doing being the necessity for more room for drills and physical exercises.

(2) An item for the purchase of an electric-light plant. The necessity for much study in artificial light and the great importance of good eye-

sight to the officers of the Navy dictate the necessity, and eventu economy, of using the very best artificial light obtainable.

(3) For the purchase of new furniture for the cadets' quarters. The furniture now in use has been in use so long that it is worn out and requires replacing.

REPORT OF THE PRACTICE CRUISE.

Commander P. F. Harrington, U. S. Navy, commanding United States practice ship *Constellation*, reports that the practice cruise was a useful one, notwithstanding the interruption caused by the necessary return to Annapolis for the trial by court-martial of some of the cadets who had been guilty of hazing. The new system of practical instruction, coupled with the giving of regular marks for practical work, gave excellent results and will cause much more attention to be given by the cadets to their practical instruction, besides making such work a valuable factor in the make-up of the future graduates. Commander Harrington condemns the practice of hazing in the strongest terms as being demoralizing to the older cadets and destructive of the self-respect of the younger ones.

REPORT OF THE BOARD OF VISITORS.

The Board of Visitors appointed to visit the United States Naval Academy, consisting of Rear-Admiral C. R. P. Rodgers, U. S. Navy, president; Hon. E. C. Walthall, United States Senate, vice-president; Hon. Algernon S. Paddock, United States Senate, Hon. George D. Wise, Member of Congress, Hon. W. McAdoo, Member of Congress, Hon. C. A. Boutelle, Member of Congress, S. P. Gillett, esq., J. W. Browne, esq., J. Preston Knott, esq., J. P. Stanton, esq., and Francis J. Cully, esq., recommend the reduction of the course from six to four years, the former term being no longer necessary to reduce the number of appointments to the Navy; also the division of the first class into divisions for the study of the specialties of the branch of the service which they are to enter on graduation.

They report the grounds and buildings generally in excellent condition, and the sanitary condition as highly creditable to the chief medical officer. They recommend in this connection a boat-house for the preservation of the steam launches, and the careful consideration of the subject of new quarters for the cadets; that some use be made of the now unused general naval hospital situated on a part of the grounds, and that additional quarters be provided for officers.

The drills and exercises in the various practical branches made a favorable impression upon them; they recommend that better fitting sails be provided for the *Wyoming*, to be used until a new and fully-equipped ship can be procured; the present suit is too small and is unsightly, tending only to engender a habit of slovenliness.

The system of academic organization, as well as interior discipline, is excellent and the standard high.

The course of study in steam engineering is commended, but a modern type of engine should replace the obsolete one used in that department.

In the department of physics the board recommends the addition of the electrical appliances used on board a modern man-of-war.

The course of study in mathematics and mechanics is ample and the instruction thorough.

The studies in English history, law, and modern languages are highly commended, and especial praise is due to those in mechanical drawing, which has now become such an important factor in the make-up of a modern naval officer.

The financial accounts were found in excellent condition. They recommend that the $24,500 belonging to the store fund be made a permanent fund.

The library is reported in good condition. A more durable form of binding than that allowed by law is recommended.

The board recommends that additional weight be given to practical professional duties in computing the standing of cadets.

The Board concurs in the Superintendent's recommendations in regard to the purchase of land to connect the present lands of the Academy, and in regard to a permanent force of general service men for duty at the Academy.

The Board commends the presence of the North Atlantic Squadron at the graduating exercises as furnishing a valuable opportunity for practical observation of life on board our ships of war.

REPORT OF THE NAVAL REPRESENTATIVE AT THE CINCINNATI CENTENNIAL EXPOSITION.

Lieut. Richard Rush, U. S. Navy, the officer detailed by the Department as its representative at the Cincinnati Exposition, reports upon the completeness of the exhibit furnished by the Bureaus, which illustrated the past history, the future material, and the scientific work of the Navy. Great interest was manifested at this exposition in all matters relating to the Navy by the large number of visitors. The Department has commended Lieutenant Rush for the energy shown by him and by his assistants in collecting in a very short time and skilfully arranging its exhibits.

MARINE CORPS.

Colonel-Commandant Charles G. McCawley, U. S. Marine Corps, reports the corps almost at its allowed strength, there being 1,890 enlisted men on the rolls October 1, 1888, about half of whom were at sea, the other half doing duty at the shore stations. The number of re-enlistments was only 125 and the deserters numbered 419.

The commandant again recommends an increase in the number of officers of higher grades and of that of second lieutenant. He also

recommends that 500 enlisted men be added to the corps to meet the future needs of the service.

Owing to the reduction by Congress of the appropriation for new quarters at Norfolk to $30,000, an additional estimate of $15,000 is made, the amount appropriated not being sufficient.

The quarterly inspections of the different posts during the past y[ear] show them to be in a satisfactory condition.

Very respectfully,

WM. C. WHITNEY,
Secretary of the Navy.

SUPPLEMENT.

Table of war vessels with 19-knot speed and upwards (not including torpedo boats), including all now building so far as known.

Description.	Name.	Nationality.	When launched.	Displacement in tons.	Indicated horse-power.	Coal capacity.	Speed.
						Tons.	Knots.
P. C*	Blake	B.	Bdg.	9,000	24,000	1,800	22.0
P. C	Blenheim	B.	Bdg.	9,000	24,000	1,800	22.0
T. C†	Vulcan	B.	Bdg.	6,600	....	....	....
P. C	Alfonso XIII	Sp.	Bdg.	4,800	11,000	1,200	20.5
P. C	Lepanto	Sp.	Bdg.	4,800	11,000	1,200	20.5
P. C	Reina Regenta	Sp.	1887	4,800	11,000	1,100	20.5
B. C‡	Aurora	B.	1836	5,000	8,500	900	19.0
B. C	Australia	B.	1887	5,000	8,880	900	18.8
B. C	Galetea	B.	1887	5,000	9,410	900	19.0
B. C	Immortalite	B.	1887	5,000	8,500	900	19.0
B. C	Narcissus	B.	1887	5,000	8,500	900	19.0
B. C	Orlando	B.	1887	5,000	8,620	900	19.2
B. C	Undaunted	B.	1886	5,000	8,600	900	19.4
P. C	Alger	F.	Bdg.	4,000	....	....	19.0
P. C	Cécile	F.	Bdg.	5,680	9,600	....	19.0
P. C	Dupuy de Lôme	F.	Bdg.	4,000	....	1,630	19.0
P. C	Jean Bart	F.	Bdg.	4,000	....	1,630	19.0
P. C	Tage	F.	Bdg.	6,950	10,330	1,000	19.0
P. C	Adm. Karniloff	R.	1887	5,030	8,200	....	19.0
P. C	Naniwa	J.	1885	3,750	7,500	....	19.0
P. C	Takachiho	J.	1885	3,750	7,500	....	19.0
P. C	Charleston	A.	1888	3,730	7,500	800	19.0
P. C	Baltimore	A.	1888	4,410	9,000	850	19.0
P. C	Philadelphia	A.	Bdg.	4,410	9,000	850	19.0
P. C	San Francisco	A.	Bdg.	4,080	9,000	850	19.0
P. C	Newark	A.	Bdg.	4,080	8,500	850	19.0
	(Act of September 7, 1888)	A.	....	5,300	....	....	20.0
	Do	A.	....	3,000	....	....	19.0
	Do	A.	....	3,000	....	....	19.0

* P. C., protected cruiser. † T. C., torpedo catcher. ‡ B. C., belted cruiser.

Summary of 19-knot ships of 3,000 tons displacement and upwards.

	No. of ships.	Total displacement.
Great Britain	10	59,600
United States	8	32,010
France	5	24,630
Spain	3	14,400
Japan	2	7,500
Russia	1	5,030

APPENDIX.

No. 1.—ESTIMATES, ETC., SECRETARY'S OFFICE.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1890, by the Navy Department.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1889.
SALARIES, OFFICE SECRETARY OF THE NAVY.		
Secretary (appropriated July 11, 1888)	$8,000	
Chief clerk (appropriated July 11, 1888)	2,500	
Disbursing clerk (appropriated July 11, 1888)	2,250	
Two clerks of class four (appropriated July 11, 1888)	3,600	
One clerk of class four in charge of files and records (appropriated July 11, 1888)	1,800	
Two clerks of class three (appropriated July 11, 1888)	3,200	
One stenographer (appropriated July 11, 1888)	1,600	
One clerk of class two (appropriated July 11, 1888)	1,400	
Four clerks of class one (appropriated July 11, 1888)	4,800	
Two clerks, at $1,000 each (appropriated July 11, 1888)	2,000	
One telegraph operator (appropriated July 11, 1888)	1,000	
One carpenter (appropriated July 11, 1888)	900	
Two messengers, at $840 each (appropriated July 11, 1888)	1,680	
Three assistant messengers, at $720 each (appropriated July 11, 1888)	2,160	
Two messenger boys, at $420 each (appropriated July 11, 1888)	840	
One messenger boy (appropriated July 11, 1888)	240	
One laborer (appropriated July 11, 1888)	660	
One clerk of class two, for Inspection Board (appropriated July 11, 1888)	1,400	
One clerk of class one, for Examining and Retiring Board (appropriated July 11, 1888)	1,200	
Three clerks of class four, for Office of Detail (appropriated July 11, 1888)	5,400	
One clerk of class three, for Office of Detail (appropriated July 11, 1888)	1,600	
Two clerks of class two, for Office of Detail (appropriated July 11, 1888)	2,800	
One laborer, for Inspection Board (appropriated July 11, 1888)	660	
Total	51,690	$51,690
SALARIES, OFFICE OF THE JUDGE-ADVOCATE GENERAL.		
Two clerks of class four	3,600	
One clerk of class three	1,600	
Three clerks of class one	3,600	
One clerk	1,000	
One copyist	720	
One laborer	660	
Total	11,180	11,180
CONTINGENT, NAVY DEPARTMENT.		
Stationery, furniture, newspapers, plans, drawings, drawing materials, horses, carriages, freight, expressage, postage, and other absolutely necessary expenses of the Navy Department and its various bureaus and offices	12,000	12,000
PRINTING AND BINDING.		
Printing and binding for the Navy Department and bureaus thereof	60,000	60,000

Estimates of appropriations required for the service of the fiscal year, etc.—Continued

Detailed objects of expenditure, and explanations.		Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fisc year en[d]ing June 30,
PAY OF THE NAVY.			
For pay of officers on sea-duty; officers on shore and other duty; officers on waiting orders; officers on the retired-list; Admiral's and Vice-Admiral's secretaries; clerks to Commandants of yards and stations; clerks to paymasters at yards and stations, inspections, receiving-ships, and other vessels; extra pay to men re-enlisting under honorable discharge; pay to petty-officers, seamen, landsmen, and boys, including men in the engineers' force, and for the Coast Survey service and Fish Commission, 7,500 men and 750 boys, at the pay prescribed by law		$7, 541, 779	$7, 082, 4
NOTE.—The foregoing estimate is made up as follows:			
Pay of 1,528 officers on the active-list	$3, 513, 000		
Pay of 285 naval cadets under instruction	143, 500		
Pay of 365 officers on the retired-list	866, 279		
Pay of 2 secretaries and 91 clerks	120, 000		
Pay of petty-officers, seamen, landsmen, and boys	2, 800, 000		
Extra pay to petty-officers and seamen re-enlisting under honorable discharge (900), at an average of $110	99, 000		
Total	7, 541, 779		
Increase over appropriation, 1889	459, 375		
This increase arises as follows:			
Increased pay to officers under decisions of the Supreme Court.	100, 000		
Increased pay to petty-officers and seamen under new classification and rates proposed	300, 000		
Increase in bounty to additional number re-enlisting under honorable discharge	9, 000		
Increase on account of additional number of cadets under instruction	30, 500		
Increase on account of increase in clerks	6, 500		
Increase on account of different assignment of officers to duty.	40, 096		
Total	486, 096		
Decrease in pay of retired officers	26, 721		
Increase over appropriation, 1889	459, 375		
PAY, MISCELLANEOUS.			
For commissions and interest; transportation of funds; exchange; mileage to officers while traveling under orders in the United States, and for actual personal expenses of officers while traveling abroad under orders, and for traveling expenses of apothecaries, yeomen and civilian employés, and for actual and necessary traveling expenses of naval cadets while proceeding from their homes to the Naval Academy for examination and appointment as cadets; for rent and furniture of buildings and offices not in navy-yards; expenses of courts-martial, prisoners and prisons, and courts of inquiry, boards of investigation, examining boards, with clerks and witness' fees, and traveling expenses and costs; stationery and recording; expenses of purchasing, paymasters' offices of the various cities, including clerks, furniture, fuel, stationery, and incidental expenses; newspapers and advertising; foreign postage; telegraphing, foreign and domestic; telephones; copying; care of library, including purchase of books, prints, manuscripts, and periodicals; ferriage, tolls, and express fees; cost of suits, commissions, warrants, diplomas, and discharges; relief of vessels in distress; canal tolls and pilotage; recovery of valuables from shipwrecks; quarantine expenses; reports, professional investigation, cost of special instruction at home or abroad in maintenance of students and attachés, and information from abroad and the collection and classification thereof, and other necessary incidental expenses		225, 000	215, 0
CONTINGENT, NAVY.			
For all emergencies and extraordinary expenses arising at home or abroad, but impossible to be anticipated or classified, exclusive of personal services in the Navy Department or any of its subordinate bureaus or offices at Washington, D. C		7, 000	7

Estimate of amount required to pay the officers of the U. S. Navy for the fiscal year ending June 30, 1890.

Grade—active list	Total number.	Sea duty. Number.	Sea duty. Pay per annum.	Sea duty. Total amount.	Other duty. Number.	Other duty. Pay per annum.	Other duty. Total amount.	Waiting orders. Number.	Waiting orders. Pay per annum.	Waiting orders. Total amount.
Admiral	1	.....	......	....	1	$13,000	$13,000	.....	......	....
Vice-admiral	1	.....	......	....	1	8,000	8,000	.....	......	....
Rear-admirals	6	4	$6,000	$24,000	2	5,000	10,000	.....	......	....
Commodore, chief of bureau	1	.....	......	....	1	5,000	5,000	.....	......	....
Commodores	9	2	5,000	10,000	4	4,000	16,000	3	$3,000	$9,000
Captain, chief of bureau	3	.....	......	....	3	5,000	15,000	.....	......	....
Captains	42	12	4,500	54,000	25	3,500	87,500	5	2,800	14,000
Commanders	85	24	3,500	84,000	45	3,000	135,000	16	2,300	36,800
Lieutenant-commanders:										
After four years from date of commission	53	25	3,000	75,000	19	2,600	49,400	9	2,200	19,800
First four years from date of commission	21	12	2,800	33,600	8	2,400	19,200	1	2,000	2,000
Lieutenants:										
After five years from date of commission	205	93	2,600	241,800	98	2,200	215,600	14	1,800	25,200
First five years from date of commission	45	24	2,400	57,600	16	2,000	32,000	5	1,600	8,000
Lieutenants, junior grade:										
After five years from date of commission	28	15	2,000	30,000	10	1,700	17,000	3	1,400	4,200
First five years from date of commission	47	25	1,800	45,000	21	1,500	31,500	1	1,200	1,200
Ensigns:										
After five years from date of commission	120	64	1,400	89,600	46	1,200	55,200	10	1,000	10,000
First five years from date of commission	61	56	1,200	67,200	4	1,000	4,000	1	800	800
Naval cadets (undergraduates)	75	75	950	71,250	.....	......	....	.....	......	....
Medical director:										
Chief of bureau	1	.....	......	....	1	5,000	5,000	.....	......	....
After twenty years from date of commission as surgeon	14	1	4,400	4,400	10	4,000	40,000	3	3,000	9,000
Medical inspectors:										
Fleet surgeons	3	3	4,400	13,200	.....		....	.....	......	....
After twenty years from date of commission as surgeon	12	4	4,400	17,600	6	4,000	24,000	2	3,000	6,000
Surgeons:										
Fourth five years from date of commission as surgeon	9	2	3,700	7,400	5	3,600	18,000	2	2,800	5,600
Third five years from date of commission as surgeon	12	9	3,500	31,500	2	3,200	6,400	1	2,600	2,600
Second five years from date of commission as surgeon	13	6	3,200	19,200	7	2,800	19,600	.....	......	....
First five years from date of commission as surgeon	16	7	2,800	19,600	8	2,400	19,200	1	2,000	2,000
Passed assistant surgeons (after five years from date of appointment)	50	27	2,200	59,400	19	2,000	38,000	4	1,700	6,800
Assistant surgeons:										
After five years from date of appointment	4	.....	......	....	2	1,600	3,200	2	1,200	2,400
First five years from date of appointment	22	15	1,700	25,500	7	1,400	9,800	.....	......	....
Not in line of promotion	2	1	2,100	2,100	1	1,800	1,800	.....	......	....

Estimate of amount required to pay the officers of the U. S. Navy for the fiscal year ending June 30, 1890—Continued.

Grade—active list.	Total number.	Sea duty. Number.	Sea duty. Pay per annum.	Sea duty. Total amount.	Other duty. Number.	Other duty. Pay per annum.	Other duty. Total amount.	Waiting orders. Number.	Waiting orders. Pay per annum.	Waiting orders. Total amount.
Pay directors:										
Chief of bureau	1				1	$4,000	$5,000			
After twenty years from date of commission as paymaster	12				8	4,000	32,000	4	$3,000	$12,000
Pay inspectors:										
Fleet paymasters	3	3	$4,400	$13,200						
After twenty years from date of commission as paymaster	10				6	4,000	24,000	4	3,000	12,000
Paymasters:										
After twenty years from date of commission as paymaster	12	3	4,200	12,600	7	4,000	28,000	2	3,000	6,000
Fourth five years from date of commission as paymaster	8	6	3,700	22,200	1	3,600	3,600	1	2,800	2,800
Third five years from date of commission as paymaster	12	8	3,500	28,000	3	3,200	9,600	1	2,600	2,600
Second five years from date of commission as paymaster	10	3	3,200	9,600	5	2,800	14,000	2	2,400	4,800
First five years from date of commission as paymaster	1	1	2,800	2,800						
Passed assistant paymasters:										
After five years from date of commission	20	9	2,200	19,800	9	2,000	18,000	2	1,700	3,400
First five years from date of commission	4	3	2,000	6,000				1	1,500	1,500
Assistant paymasters (after five years from date of commission)	14	8	1,900	15,200	4	1,600	6,400	2	1,200	2,400
Chief engineer (chief of Bureau)	1				1	5,000	5,000			
Fleet engineers	3	3	4,400	13,200						
After twenty years from date of commission	18	1	4,400	4,400	11	4,000	44,000	6	3,000	18,000
Fourth five years from date of commission	15	4	3,700	14,800	9	3,600	32,400	2	2,800	5,600
Third five years from date of commission	7	3	3,500	10,500	3	3,200	9,600	1	2,600	2,600
Second five years from date of commission	13	6	3,200	19,200	7	2,800	19,600			
First five years from date of commission	13	9	2,800	25,200	1	2,400	2,400	3	2,000	6,000
Passed assistant engineers:										
Fourth five years from date of appointment	32	13	2,700	35,000	17	2,350	39,950	2	1,950	3,900
Third five years from date of appointment	16	7	2,450	17,150	7	2,250	15,750	2	1,900	3,800
Second five years from date of commission	18	11	2,200	24,200	7	2,000	14,000			
First five years from date of commission	11	4	2,000	8,000	5	1,800	9,000	2	1,500	3,000
Assistant engineers:										
After five years from date of commission	44	15	1,900	28,500	28	1,600	44,800	1	1,200	1,200
First five years from date of commission	24	22	1,700	37,400	2	1,400	2,800			
Chaplains:										
After five years from date of commission	22	7	2,800	19,600	7	2,300	16,100	8	1,900	15,200
First five years from date of commission	2							2	1,600	3,200
Professors of mathematics:										
After fifteen years from date of commission	6				6	3,500	21,000			
Third five years from date of commission	3				3	3,000	9,000			

Second five years from date of commission	3				3	2,700	8,100			
Chief constructor (chief of Bureau)	1				1	5,000	5,000			
Naval constructors:										
Fourth five years from date of commission	1				1	4,000	4,000			
Third five years from date of commission	5				5	3,700	18,500			
Assistant naval constructors:										
After eight years from date of commission	3				3	2,600	7,800			
Second four years from date of commission	4				4	2,200	8,800			
First four years from date of commission	6				4	2,000	8,000	2	2,000	4,000
Civil engineers:										
Third five years from date of commission	6				5	3,000	15,000	1	2,100	2,100
Second five years from date of commission	4				3	2,700	8,100	1	1,800	1,800
Boatswains:										
After twelve years from date of appointment	22	8	1,800	14,400	11	1,600	17,600	3	1,200	3,600
Fourth three years from date of appointment	6	4	1,600	6,400	1	1,300	1,300	1	1,000	1,000
Third three years from date of appointment	3	3	1,400	4,200						
First three years from date of appointment	2	2	1,200	2,400						
Gunners:										
After twelve years from date of appointment	31	7	1,800	12,600	19	1,600	30,400	5	1,200	6,000
Third three years from date of appointment	1				1	1,300	1,300			
Second three years from date of appointment	2	2	1,300	2,600						
First three years from date of appointment	2	1	1,200	1,200	1	900	900			
Carpenters:										
After twelve years from date of appointment	34	10	1,800	18,000	22	1,600	35,200	2	1,200	2,400
Fourth three years from date of appointment	8	3	1,600	4,800	4	1,300	5,200	1	1,000	1,000
Third three years from date of appointment	7	5	1,400	7,000	2	1,300	2,600			
Second three years from date of appointment	1				1	1,000	1,000			
Sailmakers:										
After twelve years from date of appointment	24	12	1,800	21,600	8	1,600	12,800	4	1,200	4,800
Fourth three years from date of appointment	2	1	1,600	1,600	1	1,300	1,300			
Third three years from date of appointment	2	2	1,400	2,800						
Mates	32	11	900	9,900	20	700	14,000	1	500	500
Total	1,528	726		1,579,100	650		1,531,300	152		302,600

Total pay for 1,528 officers on active list	$3,413,000
Estimated increase under decisions Supreme Court, United States	100,000
Total	3,513,000

Estimate of the amount required to pay retired officers of the United States Navy for the fiscal year ending June 30, 1890.

Grade.	No.	Pay per annum.	Amount.	Grade.	No.	Pay per annum.	Amount
Rear-admirals	48	$4,500	$216,000	Paymasters	2	$2,400	$4
Commodores	14	3,750	52,500	Do	1	1,400	1
Captains	9	3,375	30,375	Past assistant paymasters	1	1,650	1
Do	2	2,250	4,500	Do	1	1,500	1
Commanders	8	2,625	21,000	Assistant paymasters	1	1,425	1,
Do	2	1,750	3,500	Chief engineers	9	3,300	29,70
Lieutenant-commanders	12	2,250	27,000	Do	4	2,625	10
Do	4	2,100	8,400	Do	3	2,400	7,
Do	7	1,500	10,500	Do	1	2,100	2
Lieutenants	20	1,950	39,000	Do	1	1,600	1
Do	2	1,800	3,600	Past assistant engineers	2	2,025	4
Do	4	1,300	5,200	Do	8	1,838	14
Do	1	1,200	1,200	Do	6	1,650	9
Lieutenants, junior grade	9	1,500	13,500	Do	7	1,500	10
Do	2	1,350	2,700	Do	2	1,100	2,
Do	3	1,000	3,000	Do	1	1,225	1,225
Do	2	900	1,800	Do	1	1,000	1,000
Ensigns	3	1,050	3,150	Assistant engineers	16	1,425	22
Do	3	900	2,700	Do	5	1,275	6
Do	3	700	2,100	Do	2	950	1,
Do	2	600	1,200	Do	3	850	2,550
Medical directors	3	3,750	11,250	Chaplains	7	2,100	14,700
Do	18	3,300	59,400	Professors of mathematics	3	2,625	7
Medical inspectors	4	3,300	13,200	Do	1	3,000	3
Do	2	2,200	4,400	Naval constructors	2	3,750	7
Surgeons	3	2,625	7,875	Do	2	3,000	6
Do	1	2,400	2,400	Civil engineers	2	2,250	4
Do	2	2,100	4,200	Boatswains	17	1,350	22
Passed assistant surgeons	3	1,650	4,950	Do	1	1,050	1
Do	2	1,500	3,000	Do	3	900	2
Do	1	1,100	1,100	Gunners	18	1,350	24
Assistant surgeons	3	1,425	4,275	Carpenters	6	1,350	8
Do	1	1,275	1,275	Sail-makers	10	1,350	13
Pay directors	2	3,750	7,500	Do	1	800	
Do	6	3,300	19,800				
Pay inspectors	3	3,300	9,900	Total	365		8[illegible]
Paymasters	1	2,775	2,775				

Number of secretaries and clerks, and their, pay allowed to commandants of yards and stations, to paymasters of yards, to inspections, and on receiving-ships and cruising vessels.

Number and designation.	Where employed.	Pay per annum.	Amount
Two secretaries	To Admiral and Vice-Admiral	$2,500	$5,000
One first clerk to commandant	Navy-yard, Portsmouth, N. H	1,500	1,500
One second clerk to commandant	do	1,200	1,200
One clerk to paymaster of yard	do	1,400	1,400
One clerk to inspection of provisions and clothing	do	1,300	1,300
One first clerk to commandant	Navy-yard, Boston, Mass	1,500	1,500
One clerk to paymaster of yard	do	1,600	1,600
One clerk to inspection of provisions and clothing	do	1,600	1,600
One clerk to paymaster of receiving-ship	do	1,600	1,600
One first clerk to commandant	Navy-yard, New York, N. Y	1,500	1,500
One second clerk to commandant	do	1,200	1,200
One clerk to paymaster of yard	do	1,600	1,600
One clerk to inspection of provisions and clothing	do	1,600	1,600
One clerk to paymaster of receiving-ship	do	1,600	1,600
One first clerk to commandant	Navy-yard, League Island, Pa	1,500	1,500
One second clerk to commandant	do	1,200	1,200
One clerk to paymaster of yard	do	1,600	1,600
One clerk to inspection of provisions and clothing	do	1,600	1,600
One clerk to paymaster of receiving-ship	do	1,600	1,600
One first clerk to commandant	Navy-yard, Norfolk, Va	1,500	1,500
One second clerk to commandant	do	1,200	1,200
One clerk to paymaster of yard	do	1,400	1,400
One clerk to inspection of provisions and clothing	do	1,300	1,300
One clerk to paymaster of receiving-ship	do	1,300	1,300
One clerk to paymaster of vessels on James River	do	1,000	1,000
One first clerk to commandant	Navy-yard, Washington, D. C	1,500	1,500
Two second clerks to commandant	do	1,200	2,400
One clerk to paymaster of yard	do	1,600	1,600
One clerk to inspection of provisions and clothing	do	1,600	1,600

Number of secretaries and clerks, and their pay, etc.—Continued.

Number and designation.	Where employed.	Pay per annum.	Amount
e clerk to paymaster of receiving-ship	Navy-yard, Washington, D. C	$1,300	$1,300
e second clerk to commandant	Navy-yard, Pensacola, Fla	1,200	1,200
e clerk to paymaster of yard	do	1,400	1,400
e first clerk to commandant	Navy-yard, Mare Island, Cal	1,800	1,800
e second clerk to commandant	do	1,200	1,200
e clerk to paymaster of yard	do	1,800	1,800
e clerk to inspection of provisions and clothing	do	1,300	300
e clerk to paymaster of receiving-ship	do	1,800	1,800
e clerk to commandant	Naval Station, New London, Conn.	1,500	500
e clerk to paymaster of station	do	1,300	1,300
e clerk to commandant	Training Station, Newport, R. I.	1,500	500
e clerk to paymaster of receiving-ship	do	300	1,300
e clerk to paymaster of station	Torpedo Station, Newport, R. I	1,300	300
e clerk to superintendent	War College, Newport, R. I	1,500	1,500
e clerk to commandant	Naval Station, Key West, Fla	1,500	1,500
e clerk to paymaster of station	do	1,300	1,300
e first clerk to commandant	U. S. Naval Academy, Annapolis, Md.	1,500	1,500
e clerk to cadets' store-keeper	do	300	1,300
e clerk to general store-keeper	do	1,300	1,300
e clerk to commissary	do	1,300	1,300
e clerk to paymaster of Academy	do	1,300	1,300
e clerk to paymaster of ships	do	1,300	1,300
e clerk to commanding officer	Naval Asylum, Philadelphia, Pa	1,500	1,500
e clerk to paymaster	do	1,300	1,300
n clerks to paymasters of flag-ships		1,100	11,000
ren clerks to paymasters of second-rate ships		1,100	7,700
'enty-one clerks to paymasters of third-rate, raining, and store ships.		1,000	21,000
Total			120,000

RECAPITULATION.

tal pay for 1,528 officers on active list	$3,513,000
tal pay for 287 naval cadets under instruction, $500 each per annum	143,500
tal pay for 365 officers on retired list	866,279
tal pay for 2 secretaries and 91 clerks	120,000
Grand total	4,642,779

hedule of bids and statement of contracts awarded and entered into to wash towels and supply ice for the Navy Department during the fiscal year ending June 30, 1889.

TOWELS.

Bidder.	Date of advertisement.	Amount of bid.	Date of contract.
s. Mary M. Bennett	May 14, 1888	$0.12 per dozen	
uisa W. Scott	do	2.00 per 100	
s. A. Goines	do	1.25 per 100	
rtha E. Mann	do	.50 per 100	
via West*	do	.50 per 100	June 15, 1888
s. Martha Wood	do	1.00 per 100	
ward Campbell	do	1.00 per 100	
ry E. Green	do	1.75 per 100	
s. C. Smith	do	2 00 per 100	
celsior Laundry	do	1.00 per 100	
za Gillis	do	2.00 per 100	

ICE.

lependent Ice Company	May 22, 1888	$0.39 per 100 lbs	June 29, 1888
eat Falls Ice Company	do	.40½ per 100 lbs	
illis Ice Company	do	.40 per 100 lbs	

* Awarded by lot.

No. 2.—REPORT OF THE ADMIRAL OF THE NAVY.

OFFICE OF THE ADMIRAL,
Washington, D. C., July 18, 1888.

SIR: In common with most experienced officers I think that the b school for practice afloat is in sailing vessels, and that although a couple of steamers might well be employed as gunnery ships, the *Portsmouth*, *Jamestown*, and *Saratoga* should be retained in the Navy for the purpose of giving the apprentice boys an extended voyage to sea. An act of Congress should be passed exempting all practice ships from the operation of the 20 per cent. law of March 3, 1883, so as to allow these vessels to be repaired to any extent that may be required to make th safe and efficient.

In regard to the term of enlistment, I recommend that the regula be changed and that apprentices be shipped for ten years, with the understanding that they are eligible to the highest grades of petty officers, if found competent to fill the position.

The apprentice system, although on a limited scale, is one of the best institutions in the Navy. It is a school where boys are trained to become petty officers, seaman-gunners, and seamen.

Like everything else in the Navy, this appendage to the service has had a continued struggle for existence, and one would suppose that, instead of the training system being considered a necessity, the officer in charge, whose whole soul is enlisted in the matter, was receiving some private benefit from the appropriations necessary to keep afloat so desirable an institution.

The training system is not only beneficial to the boys by giving them a practical education, but it is a most admirable school for officers. Nowhere else in the Navy can young officers acquire so readily those habits of thought which are indispensable and which can only be acquired in sailing vessels. A different state of things exists on board a sailing vessel to what prevails on board a steamer. For the preservation of the former is required the quick eye, ready command, and prompt obedience, and habits of prompt obedience on the part of the embryo seaman can not so well be obtained except in the sailing ship.

The importance of an apprentice system is shown by the time and money devoted to it by the British Government, in order to keep up the supply of well-trained petty officers and seamen for their great navy. Our apprentice system is on a very small scale compared with that of Great Britain, for where we have hundreds, she has thousands of boys, and no pains are spared to attach them permanently to the service.

In some respects our apprentice system is better than that of Great Britain, particularly in our custom of using vessels propelled by sail alone, which keeps the attention of officers and men fixed upon *seamanship*, that most essential part of the naval profession. Without a complete knowledge of this branch neither officer nor sailor will ever be entirely efficient. The officer may be useful in ordinary times on board a steam-ship, and the sailor, having passed a considerable portion of his apprenticeship in hoisting ashes, may answer to fill a gap on a top-sail yard, but neither will be equal to the emergency when left to his own resources.

None but a thorough seaman is fit to command a ship of war. In time of danger all his faculties will be called in play, and to enable him to manage his ship with dexterity it is necessary that he should have the aid of intelligent seamen—the product of the apprentice system. Views favorable to the apprentice system are constantly gaining ground in Great Britain, and, even although the five or six thousand boys who are intended for the royal navy will ultimately serve on board steam-ships, every effort is made to send none afloat who have not been trained exclusively as seamen, for in the new class of vessels the engineer element is so abundant that it is absolutely necessary to leaven it with a modicum of old-time seamanship, not learned from books, but by actual contact with the elements.

We have experienced much difficulty in filling vacancies in our Navy from the apprentices, owing to the fact that we aimed too high in the first place, requiring too much from the apprentice boy on his entering the service. He must be of good ancestral stock, and boys were selected who were least fitted for the Navy, to whose parents hopes were held out that their son's enlistment was the stepping-stone to high positions in the service. When the fallacy of such hopes became evident, the parents never rested until their boys were discharged from their uncongenial employment.

How many hundreds of poor boys in the large cities would have been delighted to obtain the positions at which their more aristocratic brethren turned up their noses, and how much more aptitude they would have shown for the service? True policy would indicate that the farmer's son should be left to till the soil and follow in the footsteps of his illustrious predecessors, but a contrary theory has prevailed, and the waifs in the streets of our cities have received no encouragement to enlist in the Navy and fight for their country. Some persons seem to think that every apprentice should be of the highest moral character before he is permitted to go on board a ship of war, perhaps for fear he might contaminate the firemen and coal-heavers; but who knows what noble sailors these waifs we have mentioned would some day have made after having passed through the reform school of the Navy?

In a great country like the United States it is the duty of the Government to stretch out a hand and rescue a portion of the boys from perdition, by placing them on board the receiving-ship *New Hampshire*, at Coaster's Harbor Island, Newport, where, with good example and under kind treatment, they would improve morally, mentally, and physically. To vary the couplet of Pope a little, we might say:

> 'Tis education forms the common mind,
> Just as the twig is used so is the boy inclined.

As a general rule, there is a desire on the part of the officers controlling the apprentice squadron to introduce a higher education than is called for among the apprentices. To read, write, and cipher, would be a boon

that the ordinary boy would highly appreciate. This he could learn in the few months he was attached to the receiving-ship, while the study of science had better be left to the Naval Academy, where, perhaps, seamanship—the life of the Navy—may not be considered of equal importance.

I by no means object to the introduction of the farmer's sons into the naval apprentice ship, with their sturdy limbs and moral attributes, but, to use a homely phrase, that has been run into the ground. L[illegible] than 17 per cent. of that class of boys have, up to this time, remained in the Navy, not enough in fact to make the necessary number of petty officers required for the service. Leaving out the want of aptitude for the service which generally induces the boys to leave when their apprenticeship is at an end, there are too few apprentices allowed by law, and not enough to supply the cruising ships with a sufficient number to fill up their quota, for the more of these boys a commanding officer can obtain to leaven the crowd of foreign seamen now on board our ships of war, the better he feels, for the crews of our ships are generally made up of sailors from every part of the world, but mostly of the Scandinavian race, good reliable men in time of peace, who care little under what flag they sail. They are the descendants of the barbarians who once debouched upon the plains of Italy and France and helped themselves to what did not belong to them. They come and enlist in our Navy, softened in character, it is true, but they are the same free-lances as of old. They ship for money. They have no sentiment for our flag or nationality, and, possibly, if it came to an action with a ship of their own or a neighboring nation, they would haul down the Amerian colors and hoist their own.

This is a contingency against which we should provide, and we have the means of doing so through the vast number of American boys who are roaming the streets at will and who would consider government employment a boon. But a few years ago one of our sloops of war with a cosmopolitan crew was anchored in the harbor of Ville Franche. The crew represented nineteen different nationalities, and so indifferent and inefficient was the organization that some wag painted on a board and hung in the gangway: "*Ici on parle anglais!*" like the signs displayed in Paris shops.

When the *Trenton*, our best ship, lately went into commission, as fine a body of Germans, Huns, Norsemen, Gauls, Chinese, and other outside barbarians as one could wish to see, softened down by time and civilization, were on board. Out of the whole crew not more than eighty could speak the English language. Is this not a fine commentary upon the American Navy? Is not this a defect to be corrected? What is required is a larger number of native-born apprentice boys and an enlargement of the conveniences for their introduction into the service. The English have five line-of-battle ships with one brig tender to each. There is also a hulk attached to every ship-of-the-line for newly entered boys, and for various other matters. We have but one regular receiving ship at Coaster's Harbor Island, and if our Navy is to be increased we should have larger accommodations for apprentice boys. We have three sloops of war in which the apprentices are trained previous to being transferred to a regular ship. This is the best feature in our training system, for the boys receive thorough instruction in seamanship, there being no steam to interfere with the exercising.

With a steam capstan and steam winch a very few men can get a vessel under way. An officer on deck, a man at the wheel, and one at

the lead, with half a dozen on deck for general purposes, and the ship can go to sea with the rest of the crew in their hammocks. The simplicity of this maneuver may, perhaps, be cited to show the advantage steam has over seamanship, but in the case of the sailing vessel the entire crew, officers, seamen, and boys, must be on deck at their posts of duty and be keenly alive to all that is going on, quick to comprehend, and full of life to obey orders with alacrity. There is a spirit of animation here which is never seen in a steam-ship of war, the difference between a well man and a paralytic, for while in the practice-ship there is a soul beaming from the eyes of every one on board, the men and boys in a steam vessel of war look on with apathy and idleness at machine work in which they have no part, and which excites no enthusiasm.

Although the service performed in our practice-ships, which sail to the coasts of Europe and through the West Indies, is not exactly that which is performed in the modern ship of war denuded of sail power, yet the qualities developed by this service are of the utmost value to the Navy on board the latest cruisers. The officer who can properly handle one of the apprentice ships can safely be trusted with the deck of the largest commerce destroyer. To apprentice boys who have been trained in sailing ships the work of a steamer is mere child's play.

There is not an officer in the Navy who has served on board the training ships of war that does not congratulate himself on the experience he has gained, such experience as could be obtained nowhere else, and, although the original intention of establishing this little squadron was for the purpose of training boys, yet it has the double effect of serving as a school for officers, and it goes without saying that in the years to come, the officers who have received this training will make the best commanders of steamships.

The sailing ship of war has no rival as a school of instruction. It is the school that has made the sailors of years gone by proverbial for strength, activity, readiness of resource, adaptability to circumstances, patience under severe trial, and contempt of danger. These are the qualities absolutely necessary in a true sailor, which will be as essential in the future as heretofore in any class of vessel that may be used in the Navy.

What was it that gave the volunteer officers in our civil war such value but the early training they received on board sailing vessels? That training produced as fine a body of men as ever went to sea. We could not have done without them any more than we can do without them in future wars, where they will prove a powerful factor. Notwithstanding our training squadron has stood the test of time, is without doubt the best of the kind afloat—although on a small scale—and has received the approval of some of the oldest and most distinguished officers, who have spent many years in the study and practice of the apprentice system, it is now proposed to abolish the time-honored training ships and put the whole system under steam.

It has taken years to build up the apprentice system on its present plan. So far it has been properly cared for, and the Navy is beginning to reap the benefit of it. The greatest demand in the service is for seaman-gunners, and the estimation in which that class of men is held proves conclusively not only the value of the plan hitherto pursued, but that it is necessary to consider carefully before making changes that may mar if they do not destroy the service. We can not afford to surrender the high character for practical seamanship enjoyed by our Navy from the time of Paul Jones to the present day. If officers of the Navy

do not try to maintain that character for the service, who will? A steam-bark is, no doubt, a thing to produce lazy boys and hybrid seamen—at least it will not contribute to that high character for activity aloft, coolness in time of danger, determination to overcome obstacles, and knowledge of seamanship which has so distinguished American seamen f the time of the Revolutionary war.

Seamen can only be made by battling with the elements. In war of 1812, when our Navy did such brilliant service against the m powerful of navies, it was because we could draw upon the best sailors in the world, our Eastern fishermen, whose lives were spent upon the ocean, where dangers were encountered far greater than those to be met with in battle. We secured for our Navy men with hearts that were repelled by no danger, who grappled with the canvas in the darkest nights and heaviest weather, as fearless as the storm-bird which shrieked around them amid the terrors of the gale. They encountered waves mountain high and had no steam to help them battle with the enemy. It was their strength and skill that enabled them to overcome the elements, and in that school of seamanship were found men who could not only manage sails and masts but were the best gunners of their time. I doubt if, with all our modern science, we have better gunners at this day. Their seamanship was not imbibed on board steam-ships, but on the decks of sailing vessels, where these gallant spirits, laughing danger to scorn, became under good training the finest sailors in the world. I regret to say that the grand body of seamen who once made our ships of war models exists no longer, and the only chance we have of keeping up the prestige which should animate the service is to retain the *sailing* apprentice ships, which will at least furnish leading men for petty officers in the Navy.

TORPEDOES.

Since 1865 the naval powers of the world, with the exception of the United States, have been assiduously employed in attempts to perfect the torpedo. Many of the contrivances are very ingenious, illustrating novel applications of well-known principles, and some of them have been brought to great excellence. No doubt a combination of the good qualities of the numerous torpedoes in existence would lead to some very perfect device.

The principle on which the majority of these weapons is constructed is that of the "fish" torpedo. The Whitehead, constructed on this principle, maintains a high reputation, although some other inventions seem to me to possess all the good qualities of the Whitehead, with greater power. Just at present there is a halt in the opinions of those who have advocated the fish-shaped torpedo, owing to the adoption in the British and French navies of heavy steel nets for the purpose of warding off attacks from this weapon.

Within the past year important experiments have been m in England against the iron ship *Resistance*, to test the efficiency of t protection and the destructive effect of gun-cotton exploded in con t with the unprotected iron hull. The result was altogether in favor o net, which, although receiving some damage, r l every at n with mobile torpedoes to come in act collis tom. The *Resistance* was anchored made without any drawbacks to t shown that any danger to the hul use could be prevented by don Although it would, no doubt, be

nets instead of one, in time of war [illegible]
protect vessels against these missiles [illegible]

For some years I have entertained [illegible]
Whitehead and other fish torpedoes [illegible]
firmed by the experiments made [illegible]
without any nets. These experiments [illegible]
bile torpedo is not as destructive as [illegible]
built ship as was anticipated. [illegible]
water line. It appeared that [illegible]
damaged, she would not probably [illegible]
possible that in a ship built with a [illegible]
wards 12 feet, with a space of 2 feet [illegible]
water when going into action, would [illegible]
the ordinary Whitehead torpedo [illegible]
Certainly if the above was combined with [illegible]
of war could be made practically [illegible]

In the case to which I have alluded [illegible]
was given any advantage. She was [illegible]
strong as vessels will probably be [illegible]
tacks. The *Resistance* was at anchor [illegible]
could take their time and see that [illegible]
went to show that the destructive [illegible]
overestimated; against two nets it would [illegible]
against three it would be comparatively [illegible]
that should be thoroughly known [illegible]
dence in their ships, while their crews [illegible]
moralized when mobile torpedoes are [illegible]

The doubts I have long entertained [illegible]
torpedoes against strong ships protected [illegible]
any experiments I have myself witnessed [illegible]
read. I place great faith in the opinion [illegible]
lant commander-in-chief of the Turkish [illegible]
portunity to witness in actual war [illegible]
he asserts that it effected nothing.

The torpedo, no doubt, can be made [illegible]
appliances, but as matters now [illegible]
comparatively useless against [illegible]
which would hold their own, [illegible]
with nets enough to keep out a [illegible]
pause for a while before torpedoes [illegible]
page would only be temporary, [illegible]
cities to move inland with their [illegible]
great guns will command the [illegible]
entrance into the harbor, can, [illegible]
party of divers to the bottom [illegible]
mines. These are at present [illegible]
dangerous, and these become less [illegible]
some time under water.

In the various trials made with [illegible]
it has been shown that they can [illegible]
many circumstances that are apt [illegible]
get practice is not so accurate [illegible]
a fish torpedo sent off below the [illegible]
to contend against, would [illegible]
to be the case in practice [illegible]
against one of the large [illegible]

In February, 1887, an experiment was made with the Whitehead torpedo by Her Britannic Majesty's ship *Polyphemus*, a torpedo-ram, 250 feet between perpendiculars, but not showing much extent of surface above water. While running at a speed of 18 knots the *Polyphemus* fired a number of torpedoes, which were badly scored and broken on ejection from the vessel's tubes. They also deflected so as to run aft parallel with the ship, thus endangering the propellers. This does not speak well for the efficiency of torpedoes fired from a vessel under high speed, although experiments under low speed proved more satisfactory. Low speed is not, however, a condition to be sought for in battle, high speed under such circumstances being most desirable.

In July, 1886, experiments were tried with the *Polyphemus* while she was advancing, bows on, towards a vessel securely moored. Under these circumstances not one of three torpedoes struck the *Polyphemus*; their direction was wild, and the question of how they became deflected could not be settled. Three more torpedoes were then fired at the *Polyphemus* while she was passing at a distance of 200 yards with a speed of 16 knots; one of them passed astern, one passed ahead, and only one struck the vessel.

In whatever manner these missiles have been used in actual service, it has been shown that they have been deflected by churning water, which is so serious a disadvantage that it would not be wise to depend on the Whitehead to the exclusion of other devices. Judging from the different experiments, nets can be made to protect a ship against any torpedo constructed on the principle of the Whitehead, which is the best of its kind.

Although in time of battle nets may seriously diminish the efficiency of a ship of war, yet they seem to insure safety against the attacks of mobile torpedoes. No doubt there will hereafter be such improvements in the manipulation and construction of nets that they can be let down and rolled up with a facility that will relieve ships of war of the drag on their movements which they at present cause.

Owing to the introduction of steel nets for the protection of ships of war against torpedoes, new devices must be adopted to dispose of the nets before the ordinary fish torpedo can be effectively used, for it is evident that a vessel properly provided with nets could not be successfully assailed by the smaller torpedo-boats now in use, and the latter may be considered practically worthless. This is the conclusion arrived at in England and France, where large torpedo vessels are building, which can also be used as rams.

The *Condor* is one of four vessels of the same type possessed by the French navy, the others being the *Epervier*, the *Faucon*, and the *Vautour*. They are fast torpedo cruisers of medium tonnage, designed at once to combat torpedo vessels and iron-clads of larger size. The *Condor* carries five 10-centimeter cannon and six rapid-firing guns, is provided with five torpedo tubes, and can easily make 18 knots an hour. To the example of the *Condor* is said to be due the creation of the new *Scout* class of the British navy. This is a type of torpedo vessels of which a heavy iron-clad might well stand in fear. Fitted with appliances for lifting or tearing nets they would be dangerous opponents. The French have their torpedo cruisers of 1,280 tons; torpedo dispatch boats of 360 tons; sea-going torpedo boats; coast-guard torpedo boats, and picket torpedo boats, but the *Condor* type is the one which will probably be most successful and to which can be applied the power and mechanical devices for destroying steel nets.

The English have under construction nine sea-going torpedo vessels from 2,640 tons down to 1,600 tons displacement. All will be fine vessels,

very fast, with large torpedo accommodations, but they are defective for want of appliances for tearing away or lifting steel nets so that torpedoes can pass under them. Every vessel with a displacement of 1,600 tons can easily carry apparatus for lifting or destroying nets while at the same time firing their torpedo under water against an enemy's hull.

Several of the powers of Europe having entered into the race for naval supremacy, they can not afford to stop, but must go ahead. The net was a good device, but it can be destroyed by vessels that will grapple with the enemy and run the risk of the fire of his great guns. To the ram and torpedo vessel of any size will be attached the net destroyer. "Sufficient unto the day is the evil thereof." The next thing will be for inventors to go to work in order to counteract the effect of the net destroyer.

One of the best appliances I have seen for overcoming the resistance of the net around a ship of war is the torpedo-ram devised by General H. Berdan, formerly of the U. S. Army. General Berdan's design is ingenious and well worthy consideration. His proposed vessel is a ram and torpedo-boat of 1,600 tons displacement, equipped with two long, adjustable arms near the bow, one on each side. When at rest these arms lie snugly under the overhang, concealed abaft the center of rotation, where they can be charged with torpedoes. The arms have a positive motion, are controlled by powerful machinery, swing under and lift a net, discharge the torpedoes on contact very near the center line, and throw the gases up through the ship. This vessel has many excellent features and besides her own special facilities can be fitted with any other apparatus.

I am a strenuous advocate of the Ericsson torpedo vessel, firing a shell from a gun placed near the keel. Such a vessel fitted also with the Berdan apparatus would be the nearest approach to a perfect torpedo-boat that has yet been thought of. A vessel so constructed could grapple with an enemy—the only way in which a torpedo vessel is likely to be effective. The grappling process is certain, and the only cases where ships have been successfully blown up, except by submarine mines, is where the attacking party has gone alongside the enemy and applied the torpedo directly to the side or bottom.

Our country more than any other stands in need of torpedo vessels of from 1,600 to 2,600 tons displacement until we can get our new Navy fairly started. This class of vessels could be built much more rapidly than the cruiser or armor-clad, their batteries to be not larger than 6-inch rifles and fitted with machine and rapid-firing guns. Hulls on the plan of the *Polyphemus* would be good ones with which to begin.

I do not refer to vessels firing any other than submerged torpedoes. Projectiles discharged at an elevation with the expectation of securing the qualities of torpedoes, or made to descend on the decks of moving ships will prove failures. Vessels firing shells either direct or elevated should not be considered in the torpedo list.

There is some consolation for those who have spent much time in working out the mobile torpedo problem. Their torpedo-boats may yet be available as ram-torpedo-net destroyers, clearing the way for a more efficient use of the mobile torpedo. So many naval officers have embarked in the study of the torpedo system that in order to make useful that on which they have expended so much time and thought they will be obliged to fall back on the ram-torpedo-net destroyer, a vessel combining three qualities in one.

Besides the torpedo-boats enumerated in the British navy list for 1885, there have been fifty-four of the first class constructed, called the

124-feet 19-knot vessels, but what would otherwise be a valuable class of vessels, is rendered comparatively useless by the perfection to which the steel net has been brought, to say nothing of their unprotected condition.

All the nations of Europe, to say nothing of the Chinese, Japanese, Chilians, etc., have gone deeply into the torpedo business, but it is probable that owing to the protective devices that will be adopted by ships of war, including machine and rapid-firing guns, torpedoes will not prove as effective in action as has been anticipated.

No torpedo vessel will hereafter be considered effective that is not thoroughly protected with steel on the decks, bows, and sides, the thickness of this protection to be decided by actual experiment. My own experience tells me that a steel deck of 2½ inches thickness will deflect a 6-inch elongated projectile fired from an elevation of 80 feet at a distance of 40 yards, especially if the deck be smeared with tallow. This would not apply to the bows and sides of vessels, which must be made to resist at least the 6-inch rifle gun, being the one in general use in all navies, as it can be manipulated with rapidity against a quickly-moving object low in the water. A large torpedo vessel in contact with any of the large European iron-clads and lying parallel thereto, would have little to fear from ponderous guns in a turret or even from the broadside guns which would not have the requisite depression.

As for the talk about torpedo boats being serviceable in dark nights, foggy weather, etc., perhaps on occasion they may effect something under such circumstances, but means will certainly be found to provide against such attacks from any but strongly-protected vessels. Without doubt the torpedo is a destructive weapon if used against heavily armored and comparatively slow-moving ships, and fired from vessels adapted to the purpose; but quite as dangerous as the torpedo is the dynamite shell fired directly from a gun with powder, and although there have been cases where the shell has exploded within the gun and rendered it useless for service, that is owing to the fact that the dynamite was not properly prepared, or was fired without taking proper precautions to avoid friction in the particles with which the shell was loaded. Of these facts I am satisfied, and will be prepared to demonstrate them at the proper time.

Graydon's shell, even in its present shape, would prove a powerful weapon against any class of vessel. Even loaded with gun-cotton a shell would have three times the power of one charged with powder and would be secure against spontaneous combustion. No matter whether we bring dynamite shells and torpedo vessels to perfection or not, our policy lies in building fast cruisers and heavy armor-clads like the *Puritan*, *Maine*, and *Texas*. These are the heavy artillery which in all battles have decided the contest and will continue to do so, for the ingenuity of man will always contrive some plan to protect the prime factors—the great ships—from the annoyances of the small fry. It has been so thus far in the race for the supremacy of the big ships and will so continue. A country's first aim should be to protect its coasts and large cities thereon. This can only be done by heavy armor-clads and strong fortifications, carrying the most powerful guns that can be constructed.

THE NAVAL WAR COLLEGE.

I beg leave to recommend that the small sum of $12,000 requested for the support of the Naval War College may be granted, as it would be greatly to the benefit of the naval service.

The War College has encountered a most remarkable opposition ever

since its first establishment under the direction of Rear Admiral Luce, who has ever shown himself zealous for the advancement of every branch of the naval service. No one can advance any good reason for opposition to this institution, which, since it has been in operation, has gained the approbation of those who have attended the lectures on professional subjects which are there delivered, and found it the best school in existence for naval officers who have finished the course at the Naval Academy.

There has been no appropriation made for the present fiscal year, which is greatly to be regretted, for the college, considering the short time it has been in existence, has made good progress and bade fair to fill all the requirements of the naval service to which it is so necessary an appendage. Whatever opposition the college may have encountered, it is only justice to it to say that all those who have witnessed its proceedings and have benefited by its instruction consider it a most excellent post-graduate institution. Officers who have attended the lectures there given certainly ought to know whether they are conducive to the benefit of the service.

I am not assuming more than is necessary for proper education when I advocate the fostering of the War College. Similar institutions are established in England and on the continent with the object of keeping up, by means of lectures, all that the cadets may have imbibed during their course at the naval school—a course of lectures delivered by those who had themselves felt the want of like instruction. If an officer wishes to stand well in his profession he must acquire a knowledge of everything that is developed in the science of naval warfare. Not only the individual is benefited, but the Government, which is enabled to select the proper officers for particular service in case of an emergency.

It is not what an officer learns at the Naval Academy—which, after all, is but a preliminary school—that fits him for the higher duties he has to perform, but the knowledge he gains after leaving that institution. If the Academy did not exist our naval officers would, no doubt, develop high attributes and great professional skill, as in the days of Paul Jones and in the war of 1812. What those men could not acquire at a naval academy they learned by actual experience and intercourse with the world, meeting with many hard knocks while acquiring the very kind of knowledge imparted by the excellent instructors at the War College.

The officers of old days were in many cases junior in years to the present ensigns of the Navy, but who will maintain that the latter are superior to those gallant spirits who made themselves masters of their profession without aid or instruction on the part of the Government? What the Artillery School at Fort Monroe is to the Army, the War College is to the Navy, and to do anything to circumscribe the usefulness of the latter would be as senseless as to abolish the Artillery School, which, as its name implies, is a school of gunnery combined with instruction required in every branch of the military service conveyed by a similar method to that pursued at the War College.

We are about to construct a new navy, wherein the highest possible standard will be required for building, equipping, and managing the vessels. The college should therefore not only be maintained, but the Government should constantly enrich it with every available kind of information, and leave nothing undone to render it the pride of the Navy—a place where officers can assemble and compare opinions out of which will accrue benefits not possible from the Naval Academy alone.

You might as well expect a young man of twenty graduating from Harvard or Yale to enter at once into the practice of law or medicine, and expect him to compete successfully with men who had not only passed through the curriculum but had also been practically instructed by lectures in all these special branches after imbibing the rudiments from their *alma mater*.

At this moment the best authorities in Europe are not yet decided what is the best plan of battle to adopt with the new style of ships and guns, and they may be said to be as much adrift as we who have yet no ships. European commanding officers will perhaps never decide what is the best plan to pursue until a battle is actually won or lost, merely from the want of that interchange of thought and opinions on these subjects. It is this interchange of thought, this discussion of professional subjects, which most enlightens an officer in regard to his profession. If a man wraps himself up in conceit and shows no ambition to compare his views with others, he will most probably fail as a naval commander, and this may be owing in a great measure to the fact that there was no debatable ground where he could compare his own ideas with those of others, so that if his opinions were wrong they could be changed, or if right could be adopted. That is exactly what we need a war college for—to discuss war problems which do not enter into the elementary instruction of the naval profession but embrace everything in science that pertains to the service.

The Navy has much to complain of in the want of liberality that has been shown towards it. Not satisfied to be left alone to draw pay and lead an idle life, a majority of its officers are seeking information from every source that offers, yet when they propose anything that will inure to the benefit of the Government they are met by rebuffs and refusals to appropriate the small sum that would perhaps in the end be worth millions to the country. It costs $15,000 to graduate every cadet that passes through the Naval Academy. A majority of these go into civil life without giving any actual service to the Government, yet $12,000 is denied to the War College, where the building and management of ships, the construction of guns, and all other important subjects pertaining to the Navy are discussed by some of the best officers in the service. Such discussion could not be provided for in any other institution that I am aware of; here plans are examined and the system of naval tactics, now undetermined, will be finally settled.

The problem of naval tactics is yet to be solved. No battles of magnitude have been fought with great iron ships since the latter came into existence, and it is evident that in a navy where that important subject is left to the hand of chance, and not determined upon beforehand, the prospects of a victory would be very slender.

I have then only to say on the part of the Navy that the War College is an absolute necessity if it is intended to bring the service up to that standard which it should maintain in professional matters. The College is not in the way of any other department. Its proximity to the receiving-ship does not interfere with the apprentice-training, systems, although some of the officers attached to the latter claim that the College premises are wanted for a lecture-room, or model-room, or gymnasium for the apprentice boys. The best lecture-room for the latter would be the *New Hampshire*. On her capacious decks the officers could deliver lectures through the speaking trumpet which would stimulate the boys to handle masts and yards and furl sails quickly. The best gymnasium is the open double-banked boat, which, while strengthening the muscles, will teach the rowers that which is more important than handling dumb-

bells or hanging from cross-bars. On the island near where the receiving-ship is moored is sufficient space to allow the boys to exercise their legs in foot and hand ball. As a model-room any of the hulks now in "rotten row" would furnish all that is necessary for such a purpose, for I presume very few "models" would be necessary to educate an apprentice boy for the duties he would have to perform in the Navy. The models should be such as are used daily in practical instruction, and the experience of years has shown that what we have now on hand, to which the boys have daily access, is sufficient to teach the elements of the profession.

Valuable as I esteem the apprentice system to be, it should not under any circumstances be allowed to crowd out the War College, on the ground that the college building is needed for the use of the apprentices. For a number of years the apprentice system has got along on its present basis and, although an extra hulk would be no disadvantage, yet even that might be dispensed with.

BOARDS OF INSPECTION AND SURVEY.

The Boards of Inspection and Survey have examined the vessels named in the following lists. The inspections for general efficiency have, as a rule, been satisfactory, vessels fitted out or returning from cruises having been found to be under good discipline and in good condition. The ships referred to in my last annual report as not having been examined under the law of August 5, 1882, have been inspected, with the exception of the *St. Mary's*, which vessel is now in use as a school-ship for the State of New York.

Vessels inspected for general efficiency.

Name.	Date.	Remarks.
Trenton	July 13, 14, 1887	Returning from a cruise.
Ranger		Surveying vessel, Pacific coast.
Constellation	July 25, 26, 1887	Cruising, practice-ship.
Trenton	Jan. 5, 1888	Just fitted out.
Nipsic	Jan. 6, 7, 1888	Just fitted out.
Enterprise	Jan. 8, 9, 1888	Just fitted out.
Pensacola	Feb. 23, 24, 1888	Returning from cruise.
Swatara	Apr. 19, 1888	Just fitted out.
Swatara	May 23, 24, 1888	Re-inspected.
Iroquois		Returning from cruise.

RECEIVING-SHIPS.

Independence		Fair condition.
Franklin	July 13, 1887	Fair condition.
Vermont	Aug. 9, 1887	Good order.
New Hampshire	Aug. 12, 13, 1887	Training-ship, good order.
Wabash	Aug. 17, 1887	Good order.
Constitution	Sept. 8, 1887	In ordinary.

Vessels examined under section 2, *act of August* 5, 1882.

Name.	Date.	Remarks.
Saugus	June 21, 1887	Condemned; not yet appraised.
Tennessee	Aug. 10, 1887	Re-appraised ($28,000).
New York	Aug. 17, 1887	Re-appraised ($2,000); since sold at auction.
Antietam	Oct. 7, 1887	Appraised, ($1,500).

Tugs.

Name.	Date.	Name.	Date.
Monterey		Nellie	
Fortune	July 13, 1887	Mayflower	July 13, 1887
Speedwell	do	Rocket	Aug. 7, 1887
Cohasset	Aug. 12, 1887	Triana	Aug. 12, 1887
Leyden	Sept. 8, 1887		

I have the honor to be, very respectfully, your obedient servant,

DAVID D. PORTER,
Admiral, U. S. Navy.

The SECRETARY OF THE NAVY.

No. 3.—NAVAL ACADEMY.

REPORT OF THE BOARD OF VISITORS.

UNITED STATES NAVAL ACADEMY,
Annapolis, Md., June 8, 1888.

SIR: The Board of Visitors appointed to visit the United States Naval Academy and be present at the annual examinations and drills has the honor to report that it has performed that duty, and submits the following report:

The Board met on the 2d instant and organized by the election of Rear-Admiral C. R. P. Rodgers, U. S. Navy, president; Hon. E. C. Walthall, vice-president, and Lieut. C. R. Miles, U. S. Navy, secretary; the latter being detailed by the Superintendent of the Academy for that purpose.

The various committees were then appointed by the president of the Board, who were requested to submit their reports at the earliest moment.

Sessions of the Board were held daily during the continuance of the examinations.

CONDITIONS OF ADMISSION TO AND DISCHARGE FROM THE ACADEMY.

The Board, after a thorough and careful consideration of the subject, recommends that the academic course should be reduced from six to four years.

The term of six years was adopted "for the purpose of reducing the number of appointments to the Navy," but the reason for such a regulation does not now exist, as "the number of appointments is now restricted by law to the aggregate number of vacancies occurring in each year in the corps to which appointments are made, the appointment of graduates being not less than ten annually." It is believed that the proposed change will be alike beneficial to the Government and the cadets affected thereby. Their service at sea for the period of two years is without value, and entails considerable expense, while it is manifestly to their injury that they should thus be kept from preparation for those pursuits which they may propose to follow in life.

The recommendation of the academic board for the separation of the first class of cadets into divisions at the beginning of the fourth year of the course, to be thereafter "directed into special courses of study, designed to fit them for the particular branches of the naval service to which any of them are destined to be appointed," meets our approval and legislation to that end is deemed desirable.

GROUNDS, BUILDINGS, AND SANITARY CONDITIONS.

Every facility has been afforded for examining the condition of the grounds and buildings, and we find the same kept and preserved with

great care, which reflects infinite credit upon those responsible for their condition.

The grounds and buildings are generally in excellent condition; cleanliness, order, and taste are everywhere observable, and the good health of all at the Academy bespeaks its sanitary condition and the care and attention of its chief medical officer.

Some changes are needed for the convenience of the cadets. There are thirteen steam-launches that are used for drill purposes in practical maneuvering, which are now greatly exposed to all weathers for want of a proper boat-house. In winter great expense is entailed in removing the engines and boilers to a place of storage. A new boat-house would not only be a great convenience, but would preserve the machinery and boats in good condition. The sum asked by the Superintendent for this purpose should be expended in this work.

The cadets' quarters are in a large building, showing crudeness in plan, and haste and carelessness in construction, fissures already appearing in the walls.

We respectfully suggest that a new building for students' quarters is a subject that should secure careful consideration at the hands of those having the matter in charge.

In this connection we respectfully recommend that some use or disposal should be made of the now unused hospital building.

We respectfully suggest, that in view of the fact that many of the officers detailed in a professional capacity to the Academy are obliged to live in the town at great expense, that a new house on the apartment plan, or three or four small new houses, be erected for their use.

SEAMANSHIP, ORDNANCE, AND NAVIGATION.

The Board has watched with interest the various drills and exercises in seamanship, gunnery, infantry and artillery tactics, and is greatly and favorably impressed by the skill manifested by the cadets, and by the careful instruction given by the officers. Nothing could be more satisfactory or more worthy of the highest commendation than those practical exercises.

The Board recommends that better fitting sails be supplied the *Wyoming*, to be used until a new and fully equipped ship can be furnished. The sails now in use belonged to another and much smaller ship, are unsightly, and the further use of them tends only to engender a habit of slovenliness.

DISCIPLINE, DRILL, PRACTICAL EXERCISES, ADMINISTRATION, AND POLICE.

The system of academic organization as well as of interior discipline is excellent, and the standard high. The requirements are generally strict, but none of them unreasonable, and the regulations are enforced firmly, but so considerately that the most agreeable and satisfactory relations are maintained between the cadets and those who control and instruct them.

The amplest opportunities were afforded the Board to judge of the proficiency of the cadets in their various drills, which was found to be most gratifying and satisfactory, all movements being executed with the precision resulting only from a thorough personal understanding of the subject. The system of practical exercises which has been adopted is commended, and in the matter of administration and police, after careful investigation and consideration, no changes suggest themselves.

STEAM ENGINEERING.

The course of study in this department is found as extended as the time allowed will permit.

The facilities for imparting information are all that could be expected, with the exception that the marine engine is an old one of an obsolete type, and should certainly be replaced by a new and modern engine.

PHYSICS.

This department was found well supplied with all that is necessary to keep up with the advance in science of the present day, the young gentlemen receiving careful instruction in all that in any way pertains to latest discoveries.

The Board recommends that the facilities be increased for extending the study of, and practice with, electrical appliances designed for use on modern men of war. A sufficient plant can be had for about $6,000.

MATHEMATICS AND MECHANICS.

The Board has no recommendations to make in these departments. The course of study is ample and the instruction thorough, as shown by a careful inspection of the papers of the written examinations. The importance of these departments can not be overestimated, and results show them to be in competent hands.

ENGLISH STUDIES, HISTORY AND LAW, MODERN LANGUAGES, AND MECHANICAL DRAWING.

The Board finds the methods of instruction pursued in these departments, under the immediate supervision of the able and efficient officers in charge of them, respectively, are eminently satisfactory, and, in some instances, worthy of special commendation.

This is notably so with the department of Mechanical Drawing, which in this era of rapid improvement in everything pertaining to naval construction and armament has become an indispensable element in a thorough naval education; and it is particularly gratifying to note the remarkable proficiency which the cadets have exhibited in this important branch of study.

FINANCE AND LIBRARY.

The high character and intelligence of the officers in charge is sufficient guaranty of the correctness of the accounts. The system seems to be as perfect as any that could be devised. The Board recommends that the sum of $24,500, for which the paymaster acting as store-keeper of the Academy is responsible, and from which the stock of necessary supplies in the cadets' store is purchased, be appropriated, so as to remain as a permanent fund, instead of being required, as at present, to be annually re-appropriated.

The Board finds the library in good condition, the books well arranged for reference, and of a character well adapted for the purposes of the Naval Academy. As the books are in constant use for reference, it is very desirable that the binding should be of a more durable character than the ordinary cloth or half-roan now authorized by law.

It is, therefore, recommended that the library of the Naval Academy be excepted from the restrictions of the law, and be added to the list of libraries that are not restricted in the character of the binding.

SUBJECTS OF STUDY AND STANDARD OF SCHOLARSHIP.

The subjects embraced in the curriculum are admirably adapted to the purposes of the school, and we can suggest no changes that would likely be improvements. We would, however, suggest a re-arrangement of the programme of studies for the last year, in order that those cadets who have exhibited special taste and talents for engineering, and who should, therefore, be assigned to duty in the Engineer Corps, may receive additional practical training.

It also seems desirable that the class standing of a cadet be determined by his excellence in the practical duties of his profession, no less than by his proficiency in the studies that train the intellect alone; or, in other words, that due credit be given to skill.

The Board is impressed by the many-sidedness of the training afforded by the Academy; its comprehensiveness, thoroughness, and practicalness, and believe that no praise would be an exaggeration of its high excellence.

The Board heartily recommends the granting of the request of the Superintendent for a new and fully-equipped vessel of modern type, and armed with modern guns, for the training of the cadets.

The Board also suggests the serious consideration of the desirability of acquiring additional grounds contiguous to the Academy as recommended by the Superintendent. The Board also believes that a change should be made from the custom of detailing a crew for the practice ship, each year, from the "general service," and recommends that such crew be selected with special reference to the character of the men who are to be so closely associated with the cadets; this crew to be permanently attached to the Academy for service in the practice ship during the summer cruise, and during the remainder of the year they would find important service in the care of the Government property afloat at the Academy.

The Board is of the opinion that such a detail would be of great advantage to the interests of the institution.

In conclusion, the Board would state that the interest in the graduating exercises at the Naval Academy has been very greatly enhanced by the presence of the North Atlantic Squadron, to whose accomplished commander, Rear-Admiral S. B. Luce, and his officers, we have been indebted for many pleasing courtesies, as well as for valuable opportunities for practical observation of life on board our ships of war. The advantage of the presence of a fleet in actual service at the time of the annual exercises at the Academy can not fail to be appreciated, and the Board can think of no better service that the cruising squadron can render in time of peace than in furnishing the most effective of object lessons to the future officers of the Navy.

Very respectfully, your obedient servants,

C. R. P. RODGERS, *Rear Admiral.*
E. C. WALTHALL, *U. S. S.*
ALGERNON S. PADDOCK, *U. S. S.*
GEO. D. WISE, *House of Representatives.*
W. MCADOO, *M. C.*
C. A. BOUTELLE, *M. C.*
S. P. GILLETT, *Indiana.*
J. W. BROWN, *Arkansas.*
J. PROCTOR KNOTT, *Kentucky.*
J. P. BLANTON, *Missouri.*
FRANCIS J. CULLY, *Pennsylvania.*

HON. W. C. WHITNEY,
Secretary of the Navy, Washington, D. C.

REPORT OF THE SUPERINTENDENT.

UNITED STATES NAVAL ACADEMY,
Annapolis, Md., October 1, 1888.

SIR: I respectfully submit this report of the condition and progress of the Naval Academy during the past year.

The following table shows the number of cadets at the commencement of the academic year, October, 1887, and the same at the end of the year, June, 1888, together with the percentage of loss in each class:

Class.	Number, October, 1887.	Number, June, 1888.	Loss during year.
			Per cent.
First	37	35	5
Second	42	37	12
Third	55	45	22
Fourth	98	67	31½
Total	232	191	....

* Graduates.

The percentage of loss from all classes was 17, while it was 22 the previous year.

In May, 1888, 71 candidates were examined and 42 passed.

In September, 68 candidates were examined and 47 passed, or 64 per cent. passed the entering examination, while 58 per cent. passed the previous year.

The total number of cadets now in the Academy is 237, as follows:

First class	37
Second class	42
Third class	68
Fourth class	90

At the semi-annual examination in February, 1888, the following number of cadets in the different classes fell below the standard of proficiency required:

First class	7
Second class	9
Third class	3
Fourth class	9

At the annual examination in June, 1888, the following numbers in each class failed to reach the required standard:

First class	
Second class	3
Third class	8
Fourth class	8

In all these cases where there was a fair prospect that the cadet could make up the deficiency he was given an opportunity to do so at an examination given four months later; that is, in June and September respectively. Most of those who were given this opportunity have passed the required examination, as heretofore reported in detail.

During the year one cadet was dismissed for bad conduct.

Thirteen of the third class were tried for hazing fourth-class men on board the practice-ship. Nine of these were recommended for dismissal by the court, but were pardoned by the President. Every effort will be made to wipe out the last traces of this objectionable practice, and with this object in view all class organizations in either the third or fourth classes have been forbidden. These organizations have been used to perpetuate hazing and to compel obedience to the dictates of the class on the part of its members, thus depriving individuals of conscientious and independent action. The general conduct of the cadets has been excellent, and the standard of scholarship has been maintained. The course of study has been revised with a view of extending the time during which the modern languages and mechanical drawing were pursued. Experience shows that six recitations per week in these subjects is not so good as three recitations per week for double the time. On the other hand, in mathematical studies it is found that with a fixed time for the subject the best results will be obtained by daily recitations. The amount of time devoted to these studies (languages and mechanical drawing) has also been increased, as well as that for physiology and hygiene.

The time devoted to the study of navigation and international law has been diminished; believing that the latter can be advantageously studied after graduation, while more efficient instruction is to be given in navigation during the summer practice cruise. These changes went into effect at the commencement of this term.

The plan of giving more importance to practical professional work and officer-like qualities, in determining class standing, and to which I referred in my last report, has been extended during the past year. The work in the shops by the second class during the summer was marked in the same manner adopted for recitations. The practical navigation of the first class during the summer practice cruise was also marked in a similar manner. The marks given for seamanship on the summer cruise were the average of marks assigned for proficiency in the various duties of officers on board ship and upon written notes upon lessons previously assigned by the commanding officer.

In all these cases the result has been most satisfactory. The progress made in navigation has been such as to compensate for the time taken from the study during the academic year. It is proposed to still further extend this plan to include more of the practical exercises of the course, such as target-practice, sword exercise, management of boats under sail, under steam, etc.

A partial examination of the extent and nature of this manual training will show what a large place it fills in a cadet's education, and the propriety of giving it some weight in deciding his class standing. It has formed since the foundation of the school an important part of the course, and has been so developed with the growth of the Academy that it now constitutes almost an education in itself. From the young cadet's entrance until his graduation he has daily exercises planned to produce a well-developed physique and at the same time to train the hand and eye to skill in his future profession.

The cadet who enters in May devotes to practical exercises alone the time until the practice-ship sails. Commencing with the setting-up drill and the school of the soldier he is taught to carry himself erect and to walk properly. The bad habits in these matters, which boys too often acquire before coming to the Academy are, sometimes, hard to

eradicate. It is, in some cases, found necessary to continue the setting-up exercises for two or more years.

To these are added a daily swimming lesson to all who have not previously learned. A cadet obtains his first sea experience when he embarks on board the practice-ship in June with the first and third classes, where he is assigned to a station as one of the crew of a man-of-war, performing the duties usually assigned to landsmen and ordinary seamen. The daily routine of exercises which fully occupies five days in the week until September 1, familiarize him with the different parts of the ship, and teach him the names and uses of the sails, spars, and rigging. Before the cruise is over he becomes active and confident in his movements aloft, even in rough weather.

The routine for the month of September is a continuation of the spring work. Those who enter in September, together with those who entered in May, have daily exercises in the school of the soldier and school of the section. These, together with the setting-up drills and daily swimming lessons, constitute the work of each day. October 1 the academic routine commences, and continues without important interruptions until June 1. In all the duties and formations of the cadets throughout the year the strictest naval discipline is observed. To this end the cadets are divided into four divisions, and each division into an equal number of crews, the cadets of the four classes being equally distributed among the four divisions, and to each division and crew cadet officers and petty officers are appointed for the year. The discipline and excellence of each division is largely dependent upon these cadet officers, who take much pride in the progress of their divisions.

In seamanship exercises the odd-numbered crews constitute the starboard watch, and the even-numbered crews the port watch.

For drill at great-guns, boats, howitzers, or naval tactics, each crew forms a gun's crew, a howitzer's crew, or a boat's crew; and each division has charge of a division of great guns, a battery of howitzers, or a division of boats.

For infantry drill each division forms a company.

The regular drills during the academic year commence immediately after 4 o'clock each day, and continue for an hour and a half or an hour and three-quarters, depending upon the nature of the drill. On Saturdays during the spring the practical exercises commence at 8 and continue until 12 noon. During the winter they commence at 10.30 on Saturdays and continue until 12 o'clock.

Throughout the course each practical exercise is in charge of the officers who have the corresponding theoretical instruction. The instructors in ordnance and gunnery have the practical instruction in great guns, artillery, small-arms, and sword and bayonet exercise, etc. Instruction in all branches of seamanship, including boats, tactics, and signals, is given by the instructors in seamanship. Instruction in practical surveying is given by the instructors in astronomy, navigation, and marine surveying. Instruction in the shops, instruction in taking apart, putting together, and running engines, both in the shop and afloat, is given by the instructors in steam engineering.

In this way the practical work keeps pace with and harmonizes with the theoretical instruction.

At the beginning of the academic year the four divisions exercise separately and at different work. Thus the first division is exercised as a company of infantry during one week, while the second division exercises for the same length of time as a battery of artillery; the third

division is divided according to classes, the first class devoting the time to target practice with great guns, the second and third classes to exercise with pivot guns, and the fourth class to instruction in the gymnasium. The fourth division is also divided by classes, the first class devoting the time to steam tactics, using steam-launches; the second class to practice in running and handling steam-launches; the third and fourth classes to exercise in boats under oars.

The following week the first division has the exercises which the second had the previous week, the second takes those of the third, and the third those of the fourth, and the fourth those of the first; shifting each week until each division has gone over all the ground.

All divisions are then exercised together for two weeks at seamanship on board the *Wyoming*. These drills include bending and making sail, reefing, shortening, and furling sail, shifting sails and spars, and terminates with stripping the ship, in which condition she remains until the following spring, when these exercises are resumed.

These seamanship drills are followed by a week's drill of all divisions assembled as a battalion of infantry, followed by a week's drill as a battalion of artillery. As the cold weather comes on the character of the daily drills is changed to indoor work, or to such drills as do not expose to inclement weather. The same general principle is observed to give instruction by divisions, and where the exercises are not adapted to all the classes they are exercised separately, and each exercise continues daily for one week. Thus the first class has practical work in the machine shop; instruction with the broadsword; practical work in ordnance in determining strength and elasticity of gun metals; instruction with the small sword. The second class has instruction with both small sword and broadsword; in steam, navy signals, dismantling and assembling rapid-firing guns and small-arms.

The third class are taught to use the small sword; exercised at broadside guns; firing at target with small-arms; exercised at fitting wire rigging and sail-making.

The fourth class have instruction in the rigging-loft, in knotting, splicing, and fitting hemp rigging; instruction in the gymnasium; instruction in dancing, and exercise at the broadside guns.

In the spring months, when the weather moderates, the outdoor drills are resumed and continue until the end of the academic year.

The following table furnishes at a glance the time devoted to each of the exercises, remembering that each exercise is from one and a half to two hours in length, except on Saturdays, when all hands go out in the bay, in the *Wyoming*, for either seamanship drill or target practice, when the instruction occupies four hours. To this time must be added at least two and a half months for the first, third, and fourth classes, which is given to the summer practice cruise, during all of which time five days in the week are completely occupied by practical work in seamanship, navigation, gunnery, and signals:

Number of practical instructions.

Kind of instruction.	During the academic year.				Total number of instructions during academic year.	During summer months.				During months of May and September, fourth class.	Total number of instructions, exclusive of practice cruise.
	First class.	Second class.	Third class.	Fourth class.		First class.	Second class.	Third class.	Fourth class.		
Seamanship, including stripping and rigging *Wyoming*	33	33	37	35	138	(*)		(*)	(*)		138
Rigging loft			15	19	34						34
Boats under oars or sail			10	10	20	(*)	15	(*)	(*)		35
Naval tactics with steam-launches	12	8			20		5				25
Navy signals, day		5			5	(*)	3				8
Navy signals, night						(*)	3				3
Army signals, day			5		5		2				7
Army signals, night							2				2
Monitor, with great-gun practice	5				5						5
General quarters	6	6	6	6	24	(*)		(*)	(*)		24
General quarters, with target practice	4	4	4	4	16	(*)		(*)	(*)		16
Target practice, great guns	8	4			12		5				17
Pivot guns		5	9		14						14
Broadside guns			10	10	20	(*)		(*)	(*)		20
Mortars							5				5
Torpedoes	4				4						4
Practical ordnance	10	5			15						15
Howitzers afloat							5				5
Target practice, howitzers							5				5
School of section										15	15
School of battery	4	5	5	5	19						19
School of battalion artillery	8	8	8	8	32						32
Target practice, machine guns		4			4		5				9
Target practice, small-arms			9		9						9
Target practice, pistols			5		5						5
School of the soldier										38	38
School of the company	4	5	5	9	23						23
School of the battalion, infantry	10	11	11	11	43						43
Skirmish drill	4	4	4	4	16						16
Broadsword	10	9			19						19
Small sword	5	10	18		33						33
Practical instructions in deviation of compass	4				4	(*)					4
Practical instruction, navigation	†14	†13				(*)					†27
Practical instruction, surveying	†10										†10
Machine-shop and running shop engines	30 and †13	30			60		54				114 and †13
Running steam-launches		5			5		6				11
Practical instruction in chemistry			†13								†13
Gymnastics				20	20						20
Swimming										38	38
Dancing				20	20						20

* Practice cruise. † Study periods.

The instructions in seamanship and gunnery on board of the *Wyoming*, *Passaic*, and *Standish* are also made instructions in running and managing the engines and boilers of those vessels. The instructions in naval tactics are also made instructions in running and managing the engines and boilers of the steam-launches when practicable.

Nor does this total include the laboratory work in either physics or chemistry, time for both of which is taken from the recitation periods assigned to those branches. A calculation shows that the time given to practical work during the four years is one-fourth as much as that given to recitations and study during the same time. Without going into detail as to what is accomplished by this practical work, it may be said that it renders the theoretical instruction more comprehensible, and gives an exactness and reality to the subjects taught that could not be imparted in any other way.

The text-books in Ordnance and Gunnery referred to in my last report have been printed and are now in use. The text-book in Naviga-

tion has been revised and a new edition printed. The new edition of the Academy Regulations has been issued for use.

The library, which now contains over 29,000 volumes, was increased by 868 during the past year. The addition to the library building has been completed and has been in use since March.

The usefulness of a library is so largely increased by a properly prepared catalogue that I venture to submit a suggestion upon the subject. To prepare a catalogue for even a moderate sized library, in accordance with any of the schemes which have received the approval of those expert in such matters, requires much time and labor, and the force employed must be skilled in the work. So enormous is the labor required to produce a complete catalogue of a large library that it has never been accomplished. The individual efforts of libraries in this work is not sufficient; partial catalogues have been made to embrace certain features according to the most frequent uses of the library; and co-operation catalogues are being made of certain classes of current periodicals, but all this falls far short of a complete catalogue.

If all the time and money which is now being expended upon this work throughout the country could be concentrated and properly directed, I think the progress made would be vastly increased, for it is evident that when the contents of a book are once catalogued it is only necessary to reproduce that catalogue a sufficient number of times to supply one to every library containing the book.

It is the first copy which costs time and requires brains; it can be reproduced by printing, at small cost. Now, every library makes its own catalogue, thus repeating many hundred times the work which might be done but once. Unfortunately, those who have given this subject most thought, and are most competent to form an opinion, are not agreed as to the best system of cataloguing. It is, therefore, hardly to be expected that they would willingly combine their efforts upon the work.

I therefore suggest that the matter be taken in hand by the General Government. This might be accomplished by Congress providing for a board to decide upon the plan to be adopted.

Although each system now in use has its advantages, yet their differences are unimportant in comparison with the desirability of the adoption of some plan. The plan being decided upon, the work could be placed in the hands of some competent person provided with the necessary assistants to accomplish the work with as little delay as would be consistent with accuracy.

If this scheme were applied to the Congressional Library—being the largest—and to all additional books which might be submitted, until the catalogue comprehended all the desirable books in the country, the work would be accomplished.

As it is usual to print the catalogues upon separate cards for each subject of reference, it would then be possible for each library to obtain printed catalogues for each book in the library, in the same manner that other Government publications are now furnished.

The first cost of such an undertaking would be considerable and would require several years to accomplish, for the reason that comparatively few people are expert at the work, and others would have to be educated to it; but I think the total saving of labor would be very great, and the character of the work is such as could properly be undertaken by the General Government, while its educational value would be great. The urgent need of a good catalogue of the excellent library of this institution is my excuse for bringing forward such a proposition in my annual report.

I beg leave to renew the recommendation of last year regarding the enlistment of general-service men for the Academy. This requires no legislative action, and I earnestly request that authority may be granted at once to enlist at least fifty general-service men to take the place of special-service men now here as the times of the latter expire.

The cost to the Government will be reduced thereby, because the leading men for the summer practice-cruise would be selected from these men instead of requiring an entire crew for that vessel, as has been the case heretofore. The men can be enlisted at the Academy from time to time as suitable men present themselves. As stated in report of last year, these men must be intimately associated with the cadets in many of the seamanship exercises during the academic year, and particularly during the summer cruise. Their moral influence upon the cadets, for good or evil, is very great. Suitable men are to be had, but they must have the advantages of continuous service to induce them to enlist here.

Twenty-three cadets presented themselves for final examination in May last. All passed the required mental examination, but two failed upon the physical examination. Cadet Kress, who was not able to attend the examination in May, was examined in September, and was rejected physically.

Of those who passed, thirteen have been appointed ensigns in the Navy, and nine have been honorably discharged. I beg to renew my recommendation that those cadets who pass the final examination at the end of six years, and for whom there are no vacancies in the naval service, be appointed to any vacancies that may exist in the Revenue Marine.

I transmit herewith a copy of the letter which accompanied my "annual estimates for the Naval Academy for the fiscal year ending June 30, 1890;" also a "statement of the appropriation of the Naval Academy for the fiscal year ending June 30, 1888;" also a "statement of offers for supplies and service for the Naval Academy, made during the fiscal year ending June 30, 1888;" also a copy of the "summer practice-cruise report, 1888," by Commander Harrington, commanding the practice ship *Constellation*.

Very respectfully,

W. T. SAMPSON,
Commander, U. S. Navy, Superintendent.

The SECRETARY OF THE NAVY,
Washington, D. C.

ESTIMATES FOR NAVAL ACADEMY.

UNITED STATES NAVAL ACADEMY,
Annapolis, Md., September 29, 1888.

SIR: I transmit herewith the annual estimates for the support of the Naval Academy for the fiscal year ending June 30, 1890.

The following items are submitted in addition to the usual estimates:

1. For the purchase of the private property which lies between the portions of the Government land and entirely separates them.

Until this property is purchased, the eleven acres outside the Academy limits and belonging to the Academy can not be inclosed, improved, or made use of in any way benficial to the Academy.

The reasons urged for the purchase of the six acres referred to have been set forth on former occasions when the estimates have been submitted. I may now repeat the most urgent one, which is, to give the cadets more extended space for drills and exercises.

The discipline of the institution requires that the cadets should be kept habitually within the limits of the Academy, and it is, therefore, most desirable that they should have ample space for out-door exercise, which is so essential to their health and physical development as well as their happiness and comfort.

2. An item for the purchase of an electric-light plant.

The grounds and buildings are now lighted by gas which is manufactured within the grounds. The cost of gas is only 85 cents per thousand, and is of good quality.

The cadets' quarters in which they study are lighted in the best manner possible with gas, yet there are, annually, several cases of cadets whose eye-sight fails; and this notwithstanding the careful examination to which they are subjected when they enter. Where a cadet commences his course with even a moderate inclination to short-sightedness, it almost invariably increases to a degree which renders him unfit for the service.

Much of this difficulty, both in the injury to apparently good eyes and the development of latent defects in others, is caused by study by gaslight, and I think it can be largely prevented, if not entirely removed, by the use of the electric light.

The Academy is specially adapted to the efficient use of the electric light, and the maintenance of the plant would not exceed what it now costs to furnish gas, and would be more satisfactory from every point of view.

3. For the purchase of new furniture for the cadets' quarters.

Each cadet is now provided with a small iron bedstead, an iron-washstand, a wardrobe, and one chair. In addition the two occupants of a room have a table in common.

The wardrobes, tables, and bedsteads have been in use from twenty-four to thirty years, and are now worn out. The wardrobes were, originally, of too slight construction, and have been repaired so often that they are a constant source of trouble.

Many of the bedsteads were used by the Army during the war, when the Academy was an army hospital, and most of them were so bent that they fail entirely to answer their purpose.

It is proposed to replace the wardrobes, bedsteads, and tables.

Very respectfully,

W. T. SAMPSON,
Commander, U. S. Navy, Superintendent.

The SECRETARY OF THE NAVY,
Washington, D. C.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1890, by the United States Naval Academy.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Total amount to be appropriated under each head of appropriation.	Amount appropriated for the current fiscal year ending June 30, 1889.
FOR PAY OF PROFESSORS AND OTHERS.			
For one professor of mathematics and one of physics, at $2,500 each (appropriated)	$5,000.00		
For three professors (assistants), viz, one of chemistry, one of French and Spanish, and one of English studies, history and law, at $2,200 each (appropriated)	6,600.00		
For five assistant professors, viz, one of English studies, history and law, three of French, and one of drawing, at $1,800 each (appropriated)	9,000.00		
For one swordmaster ($1,500) and two assistants, at $1,000 each (appropriated)	3,500.00		
For one boxing-master and gymnast (appropriated)	1,200.00		
For one assistant librarian (appropriated)	1,400.00		
For one secretary to the Naval Academy (appropriated)	1,800.00		
For three clerks to the Superintendent, at $1,200, $1,000, and $800, respectively (appropriated)	3,000.00		
For one clerk to the commandant of cadets (appropriated)	1,200.00		
For one clerk to paymaster (appropriated)	1,000.00		
For one dentist (appropriated)	1,600.00		
For one baker (appropriated)	600.00		
For one mechanic in department of physics and chemistry (appropriated)	730.00		
For one cook (appropriated)	325.50		
For one messenger to the Superintendent (appropriated)	600.00		
For one armorer (appropriated)	529.50		
For one gunner's mate (appropriated)	469.50		
For one quarter-gunner (appropriated)	409.50		
For one coxswain (appropriated)	469.50		
For one seaman in department of seamanship (appropriated)	349.50		
For one attendant in department of astronomy and one in department of physics and chemistry, at $300 each (appropriated)	600.00		
For six attendants at recitation rooms, library, store, chapel, and offices, at $300 each (appropriated)	1,800.00		
For one band-master (apppropriated)	528.00		
For twenty-one first-class musicians, at $348 each (appropriated)	7,308.00		
For seven second-class musicians, at $300 each (appropriated)	2,100.00		
		$52,119.00	$52,119.00
For special course of study and training of naval cadets as authorized by act of Congress approved August 5, 1882 (appropriated)	5,000.00		
		5,000.00	5,000.00
FOR PAY OF WATCHMEN, MECHANICS, AND OTHERS.			
For captain of the watch and weigher, at $2.50 per diem (appropriated)	912.50		
For four watchmen, at $2 per diem (appropriated)	2,920.00		
For foreman of gas and steam heating works of Academy, at $5 per diem (appropriated)	1,825.00		
For labor at gas-works and steam buildings; for masons, carpenters, other mechanics and laborers; for care of buildings, grounds, wharves, boats, etc. (appropriated)	37,864.95		
For one attendant in purifying house of gas-house, at $1.50 per diem (appropriated)	547.50		
		44,069.95	44,069.95
FOR PAY OF EMPLOYÉS IN DEPARTMENT OF STEAM-ENGINEERING.			
For pay of mechanics and others in department of steam-engineering (appropriated)	7,824.50		
		7,824.50	7,824.50
REPAIRS AND IMPROVEMENTS.			
For necessary repairs of public buildings, pavements, wharves, and walls inclosing the grounds of the Naval Academy, and for improvements, repairs, and furniture and fixtures (appropriated)	21,000.00		
		21,000.00	21,000.00
HEATING AND LIGHTING NAVAL ACADEMY.			
For fuel and for heating the Academy and school-ships (appropriated)	17,000.00		
		17,000.00	17,000.00
For lighting the Academy grounds and buildings by electricity; cost of plant to furnish 3,000 16-candle-power lamps (submitted)	55,000.00		
		55,000.00	....

Estimates of appropriations required for the service of the fiscal year, etc.—Continued.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Total amount to be appropriated under each head of appropriation.	Amount appropriated for the current fiscal year ending June 30, 1889.
FOR CONTINGENT EXPENSES—NAVAL ACADEMY.			
For purchase of books for the library (appropriated)	$2,000.00	$2,000.00	$2,000.00
For stationery, blank-books, models, maps, and text-books, for use of instructors (appropriated)	2,000.00	2,000.00	2,000.00
For expenses of the Board of Visitors to the Naval Academy, being for mileage and $5 per diem for each member for expenses during actual attendance at the Academy (appropriated)	1,500.00	1,500.00	1,500.00
For purchase of chemicals, apparatus, and instruments in department of physics and chemistry, and for repairs of the same (appropriated)	2,500.00	2,500.00	2,500.00
For purchase of gas and steam machinery; steam pipe and fittings; rent of buildings for use of the Academy; freight, cartage, water, music; musical and astronomical instruments; uniforms for the bandsmen; telegraphing; for feed and maintenance of teams; for current expenses and repairs of all kinds, and for incidental labor and expenses not applicable to any other appropriation (appropriated)	32,000.00	32,000.00	32,000.00
For stores in department of steam-engineering (appropriated)	800.00	800.00	800.00
For materials for repairs in steam machinery (appropriated)	1,000,00	1,000.00	1,000.00
For purchase of land adjacent to Naval Academy and for inclosing and grading the same (submitted)	108,000.00	108,000.00	....
For purchase of new furniture for cadets quarters, being for 250 each, wardrobes, bedsteads, and tables (submitted)	10,000.00	10,000.00	....
RECAPITULATION.			
Pay of professors and others	....	52,119.00	52,119.00
Special course of study	....	5,000.00	5,000.00
Pay of watchmen, mechanics, and others	....	44,069.95	44,069.95
Pay of employés in department of steam-engineering	....	7,824.50	7,824.50
Repairs and improvements	....	21,000.00	21,000.00
Fuel and for heating Academy and school-ships	....	17,000.00	17,000.00
Lighting Academy by electricity (submitted)	....	55,000.00	....
Contingent expenses Naval Academy	....	41,800.00	41,800.00
Purchase of land adjacent to Naval Academy (submitted)	....	108,000.00	....
Purchase of new furniture for cadet quarters (submitted)	....	10,000.00	....

Statement of the appropriation of the U. S. Naval Academy for the fiscal year ended June 30, 1888.

Headings of the appropriation.	Amount appropriated.	Expended to June 30, 1888.	Unexpended balance.	Liabilities for supplies ordered prior to June 30, 1888.	Balance in excess of liabilities.
Pay of professors and others	$52,119.00	$49,743.51	$2,375.49	....	$2,375.49
Pay of watchmen, mechanics, and others	44,086.95	44,086.42	.53	....	.53
Pay of employés steam-engineering department	7,824.50	7,824.36	.14	....	.14
Board of Visitors, expenses of	1,500.00	1,130.92	369.08	$30.00	339.08
Special course of instruction for cadets	5,000.00	....	5,000.00	....	5,000.00
Library	2,000.00	1,280.64	719.36	519.35	200.01
Stationery	2,000.00	1,347.18	652.82	534.88	117.94
Heating and lighting	17,000.00	16,568.08	431.92	431.76	.16
Chemical apparatus and supplies	2,500.00	1,785.62	714.38	714.03	.35
Miscellaneous	32,000.00	26,542.86	5,457.14	5,456.73	.41
Repairs, general	21,000.00	20,004.94	995.06	995.04	.02
Repairs to wharves	3,000.00	3,000.00	....	....	....
Addition to library building	7,000.00	7,000.00	....	....	....
Boat-house	5,000.00	....	5,000.00	....	5,000.00
Department of steam-engineering:					
Stores	800.00	786.17	13.83	11.45	2.38
Materials	1,000.00	974.81	25.19	19.12	6.07
Total	203,830.45	182,075.51	21,754.94	8,712.36	13,042.58

Statement of offers for supplies and service for the Naval Academy made during the fiscal year ended June 30, 1888.

[Schedule of offers under advertisement June 25, 1887.]

Class 1:		
Lumber (*a*):		
Sloane & Bro		$606.00
Otto Duker & Co		609.50
Jos. Thomas & Son (incomplete)		586.00
William D. Gill *		582.25
Pattern-shop lumber (*b*):		
Sloane & Bro		99.26
Otto Duker & Co		92.25
Jos. Thomas & Son		114.75
William D. Gill *		86.76
Wharf lumber (*c*):		
Sloane & Bro		1,426.33
Otto Duker & Co		1,416.23
William D. Gill *		1,413.74
Lumber for library annex (*d*):		
Sloane & Bro		450.78
Otto Duker & Co		406.33
Jos. Thomas & Son (incomplete)		232.00
William D. Gill *		386.42
Class 2:		
Hay, 20 tons (*a*):		
John Kealey $18.75 per ton		375.00
F. H. Ridout, $18 per ton*		360.00
Oats, 700 bushels (*a*):		
John Kealey (only bid), 44 cents per bushel*		308.00
Middlings, 6 tons (*a*):		
John Kealey (only bid), $18.75 per ton*		112.50
750 lime of Tiel hollow blocks for library (*b*): †		
Gustavus Isaacs, delivered in New York		225.00
Salamander Works, delivered in New York		225.00
Fire-Proof Building Company, delivered in Baltimore*		180.00
Roofing slate (9 by 18), 4,000 (*b*): ‡		
Anchor Slate Company, in Baltimore		150.00
Garthe & Loewenstein, in Annapolis*		130.00
Portland cement, 150 barrels (*b*):		
H. W. Classens & Co. (only bid), $2.58 per barrel*		387.00
Rosendale cement, 200 barrels (*b*):		
H. W. Classens & Co., $1.35 per barrel		270.00
Basil & Parlett, $1.20 per barrel*		240.00
Calcined plaster, 30 barrels (*b*):		
H. W. Classens & Co., $1.60 per barrel		48.00
Basil & Parlett, $1.50 per barrel *		45.00
Plastering hair, 30 bushels (*b*):		
H. W. Classens & Co., 25 cents per bushel		7.50
Basil & Parlett, 23 cents per bushel*		6.90
Lime, 300 bushels (*b*):		
H. W. Classens & Co., per barrel of 3 bushels, $1.35		135.00
Basil & Parlett, 33 cents per bushel*		99.00
Bricks per M (*b*):		
Maryland Brick Company (in Baltimore):		
10,000 paving	$12.00	
30,000 dark red	9.25	
100,000 arch	8.25	
		1,222.50
George N. Potee (in Annapolis):*		
10,000 paving	12.00	
30,000 dark red	11.00	
100,000 arch	10.00	
		1,450.00
Maryland Brick Company:*		
25,000 sand brick	18.00	
1,000 long arch	60.00	
		510.00

*Accepted.
† No contract made; bought on open purchase, requisition No. 51.
‡ No contract made; bought on open purchase, requisition No. 46.

Class 2—Continued.		
Bricks per M (*b*)—Continued.		
George M. Potee:		
25,000 sand bricks	$26.00	
1,000 long arch	90.00	
		$740.00
Harness (*o*):		
S. Hunt & Son*		100.16
C. A. Friemel*		107.50
William Platt		113.00
Class 3:		
Mill work for library (*a*):		
Jos. Thomas & Son		3,355.50
Otto Duker & Co.†		2,590.90
Class 4:		
Oyster-shells, 30 bushels (delivered at Academy):		
John Kealey, 1¼ cents per bushel†		3.75
John T. Bishop, 1¾ cents per bushel		5.25
Hauling coal to the several places of delivery specified in proposals:		
J. F. Bishop:†		
First		.45
Second		.45
Third		.45
Fourth		.25
Fifth		.25
(A reduction of 15 cents per ton if suggested change in delivery of first, second, and third is made.)		
John Kealey:		
First		.55
Second		.65
Third		.70
Fourth		.40
Fifth		.35
(A reduction of 10 cents per ton if suggested change in delivery of first, second, and third is made.)		
I. B. Flood:		
First		.51¼
Second		.51¼
Third		.51¼
Fourth		.32
Fifth		.27
(A reduction of 19 cents per ton if suggested change in delivery of first, second, and third is made.)		
Class 5:		
Plumbers' supplies (*a*):		
William E. Bird & Co†		710.30
Thomas Somerville & Sons (incomplete)		585.64
Morris Tasker & Co. (incomplete)		313.66
G. W. Walthes (incomplete)		473.74
Reuter & Mallory (incomplete)		1,037.57
Thomas A. Bennett & Co		777.40
Files, etc. (*b*):		
Reuter & Mallory (incomplete)		102.60
Thomes A. Bennett & Co., files of reliance brand, not approved		124.45
C. A. Jones & Co		154.64
Anderson & Ireland†		133.08
Class 6:		
Hardware:		
†Anderson & Ireland (only bid)		235.61
Class 7:		
Range materials (*a*):		
J. E. A. Cunningham (only bid):†		
NOTE.—The prices of the several kinds of castings named being by the pound, exact amount of this contract can not be ascertained.		
Bar iron (*b*):		
William Fuller & Co		60.90
C. Winternitz & Sons†		55.92

* All unsatisfactory and declined. † Accepted.

Class 7—Continued.	
Sash weights,* 700 pounds (*c*):	
James Bates, at 1 cent†	$7.00
Wrought-iron benches (*c*):	
Dufur & Co.‡ each	12.00, 7.00
Hartford Woven-Wire Company‡ do	7.00
Iron gates for main entrance (*c*):	
J. W. Fiske †	506.00
Hayward, Bartlett & Co	1,250.00
Dufur & Co., named no price.	
Wire work for library (*c*):	
Dufur & Co., per foot §	25
Old iron rail, 6½ tons (*d*): ‖	
Annapolis, Washington and Baltimore Railroad (only bid) per ton, $25 †	162.50
Galvanized cornice, gutter, and spouting for library (*c*): ¶	
Vaile & Young:	
Cornice and gutter †	205.00
Spouting, per foot, 25 cents. †	
J. G. Hetzel & Son:	
Cornice and gutter	220.50
Spouting, per foot, 25 cents.	
J. W. Geddes:	
Cornice and gutter (made no bid for spouting)	286.55
Class 8:	
Painters' supplies (*a*):	
G. & N. Popplein, jr	401.66
Hirshberg, Hollander & Co	418.55
The William B. Price Manufacturing Company †	361.48
Varnishes, oil, etc. (*a*):	
G. & N. Popplein, jr	338.00
The William B. Price Manufacturing Company	323.93
Hirshberg, Hollander & Co	293.00
The Excelsior Varnish Company †	233.50
Glass (*b*):	
Swindell Bros. (only bid) †	144.05
Brushes, cleaning materials, etc. (*c*):	
Loud Claridge & Co. (only bid) †	115.25
Class 9:	
Carpets, etc.:	
W. & J. Sloane	419.40
Julius Lansburgh	448.82
Lyon, Hall & Co	421.59
G. S. Griffith & Co †	403.33

[Under requisition No. 18.]

Base course, lintels, etc., for library:	
M. Gault & Son	1,095.00
C. E. Ehrmann †	650.00
H. B. Hanna	1,124.00

[Under requisition No. 87.]

Cases and shelves for physical laboratory:	
Joseph Thomas & Son†	568.00
Otto Duker & Co	659.00
W. J. C. King	945.00

* No contract made, bought on open-purchase requisition No. 57½.
† Accepted.
‡ Neither bid accepted, not being satisfactory.
§ Not accepted.
‖ No contract made; bought on open-purchase requisition No. 15.
¶ No contract made; bought on open-purchase requisition No. 51.

REPORT OF PRACTICE CRUISE.

U. S. PRACTICE SHIP CONSTELLATION,
Annapolis, Md., August 31, 1888.

SIR: I have the honor to submit the following report of the practice cruise:

One hundred and thirty-eight naval cadets, of the first, third, and fourth classes, embarked on the 9th of June, and on the 14th the *Constellation* sailed from Annapolis Roads. The principal movements of the ship afterwards are shown as follows:

June 19.—Anchored in Hampton Roads.
June 21.—Sailed and passed Cape Henry.
June 23.—Arrived at Gardiner's Bay, Long Island.
June 27.—Sailed from Gardiner's Bay.
June 29.—Arrived at New London, Conn.
July 1.—Sailed from New London, Conn.
July 11.—Arrived at Annapolis Roads.
July 25.—Sailed from Annapolis Roads.
August 1.—Arrived at Vineyard Haven.
August 2.—Sailed from Vineyard Haven.
August 3.—Arrived at New Bedford, Mass.
August 6.—Sailed from New Bedford, Mass.
August 7.—Arrived at Cottage City.
August 8.—Sailed from Cottage City.
August 10.—Arrived at Newport, R. I.
August 13.—Sailed from Newport, R. I.
August 16.—Arrived at New London, Conn.
August 18.—Sailed from New London, Conn.
August 23.—Arrived at Hampton Roads.
August 26.—Sailed from Hampton Roads
August 29.—Arrived at Annapolis and the cadets disembarked.

Cadets of the first class were employed successively throughout the cruise in the various stations ordinarily assigned on board men-of-war to lieutenants, ensigns, petty officers, and seamen. The third and fourth classes performed the duties of seamen and ordinary seamen.

The first class was instructed daily, except on Sunday, whether at sea or in port, in seamanship and navigation. The third class received instruction in seamanship. The routine comprised rest and recreation on Saturday afternoon and Sunday, and instruction and exercise during the remainder of the week. Near the close of the cruise competitive examinations of the first class were held in seamanship and navigation and the order of merit in these branches was determined from the examination marks and the marks given daily during the cruise.

As the methods of instruction employed were introduced only last year, and were tried more fully during the cruise now finished, I desire to record my opinion that the very satisfactory progress made by the cadets in the brief period of the cruise is due in some degree to the character of the instruction. Books upon seamanship were not used by the cadets, and they were required to make notes from their own observations of exercises and equipments. The instruction was based largely upon these notes, in the way of explanation and correction.

The cadets certainly showed much quickness in observing and accuracy in describing matters of seamanship. They were ready and confident in many of the duties of officers. Many of them took charge with self-reliance of the duties of the officer of the deck, and performed them satisfactorily.

The prospect of examinations kept them all desirous of acquiring information, and it was found necessary on several occasions to relieve them of a part of the daily task, in order to prevent cadets studying and writing at night. The examinations were satisfactory and showed that the cadets had acquired a lasting knowledge of many practical duties of their profession.

The instruction in seamanship was done by Lieutenants C. E. Colahan, H. McCrea, H. H. Hosley, A. M. Doyle, and Ensign C. N. Atwater. Ensign W. C. P. Muir had charge of the instruction in navigation.

The success of the cruise must be ascribed in a very large degree to the professional zeal of these officers and to the able and ceaseless attention of the executive officer, Lieut. Commander C. C. Todd, to the duties of the ship and course of instruction.

The harmony of the ship was interrupted during a brief time, early in the cruise, by the hazing of fourth-class cadets by some of the third class.

Hazing usually originates in jocular passages between third-class cadets and those recently admitted into the Academy. It is sometimes the result of a deliberate assumption of superiority on the part of the third-class cadet, and an attempt to compel the new cadet to address the older one with particular and unusual marks of respect and submission. In either case, when the new cadet shows any spirit of independence or resistance, he is said to have too much "gall," and the third class cadet proceeds to teach him a greater respect for his own position and authority by compelling him to eat soap, drink vinegar, chew water-closet paper, or stand him on his head. If the fourth-class cadet still resists, a fight results, though not between the new cadet and his persecutor. The third-class cadets choose their champion, generally a cadet who has shown skill and vigor in the gymnasium, and usually the new untrained cadet gets a beating. When these affairs excite inquiry, the fourth-class cadets shrink from giving information, either from magnanimous sentiments or from fear of being ostracized or put in "coventry;" the third-class cadet evades investigation and is often led into falsehood.

During the practice cruise the third class went even further in supporting hazing, putting themselves as a class in a position of resistance to the law.

Many members of the class opposed this action, but they submitted to the determination of their class. This state of affairs brought about a court-martial, and the conviction of nine third-class cadets.

The practice of hazing and putting new cadets under many annoyances, such as not permitting them to drink milk, or to visit certain parts of the ship or Academy ground used by the third-class men, is demoralizing to the older cadets and destructive of the self-respect of the younger ones.

Very respectfully, your obedient servant,

P. F. HARRINGTON,
Commander, Commanding.

To Commander W. T. SAMPSON, U. S. Navy,
Superintendent U. S. Naval Academy.

No. 4.—BUREAU OF YARDS AND DOCKS.

BUREAU OF YARDS AND DOCKS,
NAVY DEPARTMENT,
Washington, D. C., October 1, 1888.

SIR: The following report of the operations of this Bureau for the fiscal year ending June 30, 1888, with tabulated statements of the expenditures, is hereby respectfully presented.

The estimates for the fiscal year ending June 30, 1890, accompany this report, and are submitted for your consideration.

The estimates submitted by the commandants of the various navy-yards and stations are as follows, viz:

For improvements	$2,620,710.42
For general maintenance	357,681.64
For repairs and preservation	1,095,181.88
For Naval Asylum	80,125.00
For civil establishment	67,768.20
Grand total	4,221,467.14

After a careful examination of the above estimates, the Bureau has made a material reduction in the amounts asked for, and submits the following estimates:

For support of Bureau of Yards and Docks	10,980.00
For improvements at navy-yards	1,089,248.98
For general maintenance and contingent	240,000.00
For repairs and preservation	275,000.00
For support of Naval Asylum	80,125.00
For civil establishment	49,495.60
Total	1,744,849.58

The tabulated statements that follow the report show in detail the amount of expenditures and estimates for the several navy-yards and stations and the Naval Asylum under the various heads just named.

I beg to call attention again to the advisability of gradually extending and constructing permanent water-fronts of stone or concrete at our principal navy-yards. The water-frontage that is available for use at these yards is at best inadequate, and being generally of timber is subject to decay and the ravages of the teredo.

Estimates are submitted by the Bureau for an extension of the permanent water-frontage of the two central navy-yards at Norfolk, Va., and Mare Island, California.

An estimate is submitted for the purpose of establishing plants for lighting the three most important yards at New York, Norfolk, and Mare Island by electricity. It is proposed, if this amount should be granted by Congress, to adopt the best system obtainable for the purpose, and thus light the streets and open areas, and, as far as possible, the offices and other buildings.

Aside from the increased efficiency which would result in war time, a time for which navy-yards are primarily created, such lighting in other times is of great value for emergencies, police purposes, and for work during short winter days. Even in a nation like Japan the principal Government dock-yard has been lighted by electricity for years.

It is with great satisfaction that the Bureau has noted the action of Congress in directing the preliminary steps for the settlement of the questions of the locations of navy-yards upon the Gulf of Mexico and the northwestern coast of the Pacific. The great and growing maritime and naval interests in these waters would not justify a further postponement of these important matters.

A very considerable expenditure has been made during the past fiscal year from the general appropriation for repairs and preservation for the purpose of putting the docking facilities of the navy in good order. Extensive repairs have been given to all of the various dry-docks and their appliances; some attention, however, is still required to these necessary adjuncts, which will be given, as far as possible, during the present fiscal year.

Under the heads, now following, of the different navy-yards and stations I submit my views upon such operations of the past year and estimates for the coming fiscal year as are deemed worthy of special mention.

NAVY-YARD, PORTSMOUTH, N. H.

An amount of $22,748 was expended during the past fiscal year for the extensive repair of the balance dry-dock at this station. This structure is now in excellent order, and when the repairs upon the hauling-out ways used with this dry-dock shall have been completed, there will be adequate and efficient provision for docking purposes at this yard.

I renew my estimate of $6,350, made last year, for increasing the water supply here, and submit an estimate of $6,080 for the completion of the hydrant system.

NAVY-YARD, BOSTON, MASS.

The repairs upon wharf No. 2, which amounted to an entire rebuilding of the structure, have been completed in a most substantial and satisfactory manner. The wooden caisson for the dry-dock has been thoroughly rebuilt, and considerable repairs have been made to the structure itself. I renew my request, made last year, for $25,389.25 for rebuilding wharf No. 5, this wharf being so unsafe as to be unfit for service. I also renew my estimate of $28,610, made last year, for rebuilding quarters L, M, N, and O. These houses are in such a condition that their complete reconstruction should be at once undertaken.

In examining the wooden shears formerly used for lifting heavy weights at this yard, it was found that they had decayed to such an extent as to be unfit for further service. An estimate of $7,950 is submitted and urged upon the attention of Congress for the purpose of obtaining steel shears with a lifting capacity of 100 tons for this yard, at which there is now no means whatsoever for lifting heavy weights.

NAVY-YARD, NEW YORK.

The following are the principal works of improvement that have been in progress during the past fiscal year at this very important yard.

The construction of the new timber dry-dock is progressing favorably. Before this work could be commenced it was found necessary to change the location of the main water-pipe and relief-sewer. This being done, the work was commenced by the contractors, J. E. Simpson & Co., November 14, 1887, and there is every indication that the work will be finished within the stipulated time of two years. The length ot this dock will be 500 feet, but it is to be regretted that a further extension was not authorized by Congress to a length of 600 feet; such an extension would have added materially to the docking capacity of this yard as well as to the port of New York.

The work of repairing the old or granite dry-dock at this yard, which was mentioned in my last report, has been completed in a very substantial and satisfactory manner, and this dock is now in constant use.

Building No. 7, used for offices at this yard, was partially destroyed by fire January 6, 1888. Provision was made during the present session of Congress for its reconstruction, and the work of rebuilding has been actively begun. From the general appropriations very extensive work has been done here in repairing and rebuilding the fire-engine house; in rebuilding and repairing the water front and wharfage of the yard proper and the cob-dock; in repairing and extending the railway system about the ship-house in which the armored cruiser is to be constructed, and in dredging the water-front and completing the entrance into Whitney Basin.

Further and extensive repairs are, however, urgently needed to the cob-dock, for which a special appropriation of $78,375 is asked. The portion of this water-frontage lying between the part repaired last year, and where the receiving-ship *Vermont* now lies, is decayed, undermined, and unsafe. Any temporary repairs would be a useless waste of money, and as this part of the cob-dock is very much needed for ships that are repairing and fitting for sea, there is also this additional necessity for immediate and extensive repairs.

An estimate is submitted for a sum of $50,000 to continue the work of improving Whitney Basin by erecting substantial crib-work around the inside of the basin, so that the necessary dredging can be carried on to make the basin available for larger vessels.

Estimates are also submitted for a general paint and oil store to lessen danger by fire, and for a further extension of the railroad system throughout the yard, such a system being a necessary adjunct to so large an establishment, with such heavy weights to handle.

NAVY-YARD, LEAGUE ISLAND, PENNSYLVANIA.

Provision having been made by Congress for the construction of a dry-dock at this yard and for other purposes, the Bureau deems it necessary, in order that the yard be made more available for naval purposes, to submit an estimate of $155,000 for dredging and filling in; and

Also, an estimate of $26,416 for building a landing wharf at the foot of Fifteenth street.

As quarters are now rented in the city for officers stationed here, an estimate of $30,000 is also offered for the erection of suitable dwellings at this station.

NAVY-YARD, NORFOLK, VA.

The construction of the new timber dry-dock authorized by Congress to be located here is progressing very satisfactorily. The work was commenced in November, 1887, and has been continued under generally

favorable conditions, so that, as far as it is possible to foresee, it will be completed within the stipulated time.

The erection of an engine-house and the extension of the railway system at this yard is in progress and will be completed at an early date.

Out of the general appropriations, the saw-mill was demolished to make room for the new dry-dock, and the fire-engine house removed to afford space for the sheds needed in the construction of the *Texas*. In addition to general repairs, the roof of the steam-engineering buildings is being extended, so as to inclose a space for an erecting shop. The dry-dock caisson here has been also extensively repaired.

An estimate of $150,000 is submitted for the extension of the stone quay-wall along the water front. Additional available water frontage is needed at this yard, and it can be permanently provided in this way.

The teredo is so destructive in these waters as to make the cost of the maintenance of timber wharfage expensive. There being no available anchorage space off or in the immediate vicinity of the yard, a good and sufficient line of water front is especially necessary, and if this should be provided no extension of the yard area is needed. For this reason, also, the conversion of the present shallow wet basin, built for the preservation of timber, into a deep fitting-out basin is earnestly advocated. The situation of this basin is convenient for vessels fitting out or undergoing repairs, and its use as a timber basin has almost entirely passed away.

An estimate of $100,000 for the purpose of the commencement and continuance of this work is submitted.

The quarters provided at this yard are insufficient to accommodate the officers stationed here, and an estimate of $16,000 is made for two additional houses.

NAVY-YARD, MARE ISLAND, CAL.

It is important that this yard should be placed in a thoroughly equipped condition in every respect.

An estimate is submitted, to be made available at once, for the sum of $80,000 for the purpose of completing the new stone dry-dock, so long under construction. An estimate was made by Civil Engineer Wolcott, in charge of its construction, in June, 1885, for the amount of $191,595 as being sufficient to insure the completion of the dock. No further estimate was made or money asked for until May 28, of this year, when a report was made that the amount on hand was insufficient for the completion of the dock, and an estimate was submitted for the sum of $80,000 for this purpose.

After a complete examination the Bureau finds the cause of the difference between the original estimate and the amount necessary to finish the dock to be from the delays upon the part of the contractors to furnish granite; from the increased cost, nearly 33⅓ per cent., of cutting and dressing the granite, and from the fact that the original estimate was made without due regard for the contingencies liable to occur in Government work of this character.

The dock is so far completed as to be in use for docking vessels, the French flagship *Duquesne* having been docked successfully during the past fiscal year.

The cisterns provided for by appropriation made last year have all been completed but one. They are placed at convenient points to furnish water in case of fire, and also near buildings which under ordinary circumstances will give them a supply of fresh water during the rainy season from their roofs.

The artesian well having been deepened to 1,360 feet by the bondsmen of the failing contractor without reaching water, was abandoned by him, and will be carried on by yard employés under the direction of the Bureau.

From the general appropriation of repairs and preservation, the Bureau has been enabled to do very extensive and valuable work at this yard, with respect to the medical dispensary, equatorial building, and to the roadways. The wharf south of the ferry-slip was finished and very considerable repairs made to the floating dry-dock and its appurtenances.

Probably the most important question connected with this navy-yard, at present coming under the cognizance of this Bureau, is the provision of a permanent and straight water frontage.

The waters of the stream upon which this yard is situated carry a great quantity of mud and silt, and where the line of the front is broken eddies occur and rapid deposits result. A quay-wall is partially built along this front, and gives to that extent a permanent and straight front, satisfactory in its nature and economical in maintenance. A gap of 800 feet exists from the end of the present quay-wall to the ferry-slip, and an estimate of $110,000 is submitted to enable the Bureau to commence and continue the construction of this wall during the present fiscal year.

The whole subject of the broken line of water frontage has undergone a thorough examination, and as a result of this examination the Bureau recommends that an appropriation be made to enable it to remove the present ferry-slip and reconstruct it permanently inside of the water-front line and to remove the north return-wall of the sectional dock-basin, with the old wharfage near by, and rebuild it on a line with the present water-front.

An estimate of $30,947.84 is submitted for this purpose, the importance of which can be understood when it is stated that the results of the deposits in this vicinity cause constant and serious shoaling in front of the new dry-dock, involving trouble in docking and undocking vessels and constant expense for dredging.

Additional estimates are submitted for putting the remaining working roads in permanent order, for a new gate and guard-house, for the erection of an additional 12-ton swinging crane along the water front, and the removal of the present gas-holder.

If the appropriation for inaugurating a system of electric lighting at this yard is made as requested, the necessity for the expenditure of the $16,664.09 asked for this latter purpose will be removed. The question of electric lighting in this yard is particularly important, as the gas now used is carried under water in pipes from Vallejo, and is subject to accidents from vessels anchoring, etc., thus causing both expense and annoyance.

NAVY-YARD, PENSACOLA, FLA.

As Congress has provided for a commission to examine the matter of the site of a navy-yard upon the Gulf in an exhaustive manner, no appropriation is asked for improvements at this yard until this question is finally settled.

NAVAL STATIONS, ETC.

Naval station, New London, Conn.—No work of any kind has been done or is proposed at this station, and the expenditures incurred were only such as were found necessary to care for the property now there.

Navy-yard, Washington, D. C.—This yard, though set aside principally as an ordnance manufacturing yard, requires a considerable sum annually from the funds of this Bureau for purposes of repairs and preservation and maintenance. An estimate is submitted for the permanent extension of the yard wall.

Naval station, Port Royal, S. C.—This station is now in working order as a coal depot and store-house. An estimate is submitted for a house for a second officer at this place.

Naval station, Key West, Fla.—Only the repairs absolutely necessary have been given here. I can but express my regret that provision was not made for quarters for the two officers stationed here. This station, though a very necessary one, is undesirable as a residence, and it is no more than justice that provision for quarters should be made at this place.

Naval station, Sackett's Harbor, N. Y.—This station has been closed for many years, and only the amounts necessary for the care of the little property here has been expended.

NAVAL ASYLUM, PHILADELPHIA, PA.

The expenditures at this institution for the fiscal year ending June 30, 1888, are as follows:

Pay and pocket-money of beneficiaries	$6,228.40
Tobacco	842.13
Clothing, boots, and shoes	7,820.92
Subsistence	22,984.81
Paints, dry goods, lumber, coal and wood, provender, hardware, miscellaneous and house sundries	7,578.93
For support of beneficiaries	45,455.19
Pay of employés	9,108.78
Repairs to buildings, for grates, furnaces, ranges, furniture, and repairs to furniture	3,155.41
Water rent and gas	1,442.15
Cemetery, burial expenses, and headstones	247.82
Improvement of grounds	131.85
Music in chapel	504.00
Total expenditures for year 1887-'88	60,045.20

Estimates are respectfully submitted for the Naval Asylum for fiscal year ending June 30, 1890, as follows:

For pay and pocket-money for beneficiaries	$6,600.00
For clothing, boots, and shoes	10,000.00
For tobacco	1,000.00
For provisions	24,000.00
For ice	400.00
For coal and wood	3,000.00
For stores of dry goods, paints, lumber, provender, hardware, miscellaneous and house sundries	8,000.00
For transportation of indigent and destitute beneficiaries to asylum	500.00
For pay of employés	10,025.00
For water rent and gas	1,800.00
For cemetery, burial expenses, and headstones	350.00
For improvement of grounds	500.00
For repairs to buildings, furnaces, grates, ranges, furniture, and repairs to furniture	4,500.00
For music in chapel	600.00
For cementing floor of asylum cellar	4,850.00
For erection of elevator in asylum building	4,000.00
Total	80,125.00

Capt. Edward E. Potter, U. S. Navy, now the governor of the institution, reports that the asylum building and grounds have been kept in excellent condition of repair and preservation during the past year. As far as the funds have permitted improvements have been made adding to the comfort of the inmates. The stairways of the interior have been extensively improved, two summer houses have been erected in the grounds, sidewalks have been relaid, the library and musical and other entertainments maintained.

The following table shows the changes during the past fiscal year:

On rolls July 1, 1887	193	
Original admissions	25	
Readmissions	5	
		223
Dropped for absence without leave	3	
Died	16	
Dismissed	6	
Discharged at his own request	1	
		26
On rolls July 1, 1888		197

This is a slight increase over the previous year.

As the room provided by the new back building authorized by Congress will relieve the crowding and discomfort referred to in previous reports, the question of adding to the comfort of these aged and deserving beneficiaries of the nation principally engages the consideration of the Bureau and the authorities of the institution.

An estimate of $4,000 is submitted for building a first class hydraulic elevator in the asylum with means for keeping up the necessary hydraulic pressure. This improvement is most necessary and desirable for an institution of this kind, many of the inmates being so infirm as to make the climbing of stairways a slow and painful task, and the dining-room being placed in the basement, the use of the stairways is necessarily frequent during the day.

An estimate of $4,850 is also submitted for cementing the floor of the asylum cellar. The floor just above the cellar is the one in which the dining-room is placed, and is damp, especially when the furnaces are not in operation. It is believed that the cementing of the cellar floor would remove to a great degree this source of trouble and improve the sanitary condition of the building.

The Bureau approves of the repeated recommendations of the governors of the asylum for an increase of the pay of the employés; especially is this necessary in regard to the chief cook and the assistant cooks. It is a matter so directly connected with the daily life of the inmates that pay commanding a better grade of employés in this particular will be felt most sensibly and constantly by them.

It is hoped that when the consideration of the above matters is made by Congress that it will be borne in mind that the Naval Asylum is supported, and all these improvements paid for, from the income of the naval pension fund, a fund created by the exertions of the men of the naval service, many of whom are now beneficiaries of this institution.

The Bureau desires to express its approval of the change of name, proposed in the bill that has passed the Senate and is pending in the House of Representatives, to that of "United States Naval Home," and also the bill to sell the lot known as the "wharf lot," through which the Schuylkill East Side Railroad now passes, provided a proper sewerage access to the river is given to the institution; and that the money received from this sale is to be expended for the improvement of the Naval Asylum and the provision of further comfort to its inmates.

CONTINGENT.

The sum of $40,000 is required and estimated for under this head, to be used for unforeseen emergencies and accidents that may arise calling for immediate outlay, and also to meet necessary expenditures for objects that are indispensable and for which the yearly appropriations of "General maintenance" and "Repairs and preservation" may not have proven sufficient.

GENERAL MAINTENANCE.

For this an amount of $200,000 is asked. The most necessary and pressing expenditures of the different yards come under this head, such as repairs to fire engines, purchases of horses and oxen and their maintenance, carts and tools, coal, water, and gas, telegrams, incidental labor, pay of watchmen, cleaning yards, the care of buildings, purchase of and care of machinery of every description, rents, etc. The need for the amount estimated is consequently obvious. On account of the reduced appropriations of the past few years there has been a deficiency caused in the live stock, vehicles, in furniture of houses especially, and in the funds for the general cleaning and care of the yards.

It is trusted that the reduction made by the Bureau for this purpose from the estimates submitted to it will not receive further reduction.

REPAIRS AND PRESERVATION.

The amount asked for ($275,000) under this head is reduced to what is considered absolutely necessary. It is earnestly hoped that no further reduction will be made to this general appropriation which has been reduced very greatly from the estimates submitted to it from the various yards, and is also a reduction from the amount appropriated for the present fiscal year.

The entire amount asked for by the Bureau is $1,744,849.58, the detail of which is contained on the tabulated sheets Nos. 1 to 6, recapitulated as follows:

1. For support of Bureau of Yards and Docks	$10,980.00
2. For general maintenance and contingent	240,000.00
3. For support of Naval Asylum	80,125.00
4. For repairs and preservation	275,000.00
5. For improvement at navy-yards	1,089,248.98
6. For civil establishment	49,495.60
Total	1,744,849.58

A statement showing the amount expended under each specific head of appropriation during the fiscal year ending June 30, 1888, and the balance remaining unexpended June 30, as required by section 429 Revised Statutes, is appended.

Also, a report showing amount expended during the fiscal year ending June 30, 1888, from appropriations pertaining to this Bureau for civilians employed on clerical duty or in any other capacity than as ordinary mechanics and workingmen at the several navy-yards, with estimates for the same for the fiscal year ending June 30, 1890, in compliance with the third section of naval appropriation act, approved January 30, 1885.

Very respectfully, your obedient servant,

D. B. HARMONY,
Chief of Bureau.

Hon. WM. C. WHITNEY,
Secretary of the Navy.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1890, by the Bureau of Yards and Docks, Navy Department.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Total amount to be appropriated under each head of appropriation.	Amount appropriated for the current fiscal year ending June 30, 1889.
SALARIES.			
One chief clerk (July 11, 1888)	$1,800.00		$1,800.00
One draftsman and clerk (same act)	1,800.00		1,800.00
One clerk of class four (same act)	1,800.00		1,800.00
One clerk of class three (same act)	1,600.00		1,600.00
One clerk of class two (same act)	1,400.00		1,400.00
One clerk of class one (same act)	1,200.00		1,200.00
One assistant messenger (same act)	720.00		720.00
One laborer (same act)	660.00		660.00
		$10,980.00	
		10,980.00	10,980.00
GENERAL MAINTENANCE.			
For general maintenance of yards and docks, namely: For freight and transportation of materials and stores; books, maps, models, and drawings; purchase and repair of fire-engines; machinery; repairs on steam fire-engines and attendance on the same; purchase and maintenance of oxen and horses, and driving teams; carts and timber-wheels, and all vehicles for use in the navy-yards, and tools and repairs of the same; postage on letters and other mailable matter on public service sent to foreign countries, and telegrams; stationery; furniture for Government houses and offices in the navy-yards; coal and other fuel; candles, oil, and gas; cleaning and clearing up yards and care of buildings; attendance on fires, lights, fire-engines, and apparatus; for incidental labor at navy-yards; water-tax and tolls and ferriages; rent of four officers' quarters at Philadelphia, Pa.; for pay of watchmen in navy-yards, and for awnings and packing-boxes, and advertising for yards and docks purposes (September 7, 1888)	200,000.00	200,000.00	165,000.00
CONTINGENT.			
For contingent expenses that may arise at navy-yards and stations (September 7, 1888)	40,000.00	40,000.00	20,000.00
		240,000.00	185,000.00
NAVAL ASYLUM, PHILADELPHIA, PA.			
One superintendent (September 7, 1888)	600.00		600.00
One steward, increase of $120, submitted	600.00		480.00
One matron, increase of $120, submitted (same act)	480.00		360.00
One chief cook, increase of $240, submitted (same act)	480.00		240.00
One assistant cook, increase of $192, submitted (same act)	360.00		168.00
One assistant cook, increase of $132, submitted (same act)	300.00		168.00
One chief laundress (same act)	192.00		192.00
Four laundresses, reduced two laundresses, at $168 each (same act)	672.00		1,008.00
Four scrubbers (same act)	672.00		672.00
Eight waiters (same act)	1,344.00		1,344.00
Six laborers (same act)	1,440.00		1,440.00
One stable-keeper and driver (same act)	360.00		360.00
One master-at-arms, increase of $120, submitted (same act)	600.00		480.00
One barber (same act)	360.00		360.00
One carpenter (same act)	845.00		845.00
Two house corporals, an increase of $60 each, submitted (same act)	720.00		600.00
		10,025.00	
For transportation of indigent and destitute beneficiaries to the Naval Asylum (same act)	500.00		500.00
For repairs to buildings, furnaces, grates, ranges, furniture and repairs of furniture (same act)	4,500.00		4,500.00
For water rent and gas (same act)	1,800.00		1,800.00
For cemetery, burial expenses, and head-stones (same act)	350.00		350.00
For improvement of grounds (same act)	500.00		500.00
For music in chapel (same act)	600.00		600.00

Estimates of appropriations required for the service of the fiscal year, etc.—Continued.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Total amount to be appropriated under each head of appropriation.	Amount appropriated for the current fiscal year ending June 30, 1889.
NAVAL ASYLUM, PHILADELPHIA, PA.—continued.			
For erecting brick building for kitchen, laundry, and dormitories for female employés (same act)			$17,500.00
For removing ranges and laundry machinery to same (same act)			400.00
For fitting up bath-rooms for beneficiaries (same act)			800.00
For cementing floor of asylum cellar (submitted)	$4,850.00		
For erecting elevator in asylum building (submitted)	4,000.00		
		$17,100.00	
For support of beneficiaries (same act)	53,000.00	53,000.00	46,100.00
		80,125.00	82,367.00
REPAIRS AND PRESERVATION.			
For navy-yards and stations (September 7, 1888)	275,000.00	275,000.00	300,000.00
NAVY-YARDS AND STATIONS.			
Navy-yard, Portsmouth, N. H.:			
For water supply (submitted)	6,350.00		
For hydrant system (submitted)	6,080.00		
		12,430.00	
Navy-yard, Boston, Mass.:			
For rebuilding officers' quarters L, M, N, and O (submitted)	28,610.00		
For rebuilding timber wharf No. 5 (submitted)	25,389.25		
For sheers	7,950.00		
		61,949.25	
For water-pipe and laying of same (September 7, 1888)			32,000.00
Navy-yard, Brooklyn, N. Y.:			
For rebuilding cob-dock (submitted)	78,375.00		
For improving Whitney Basin (submitted)	50,000.00		
For general paint and oil store (submitted)	25,000.00		
For railroad throughout the yard (submitted)	30,000.00		
		183,375.00	
For repairs to building on cob-dock (September 7, 1888)			5,000.00
For boiler-shop and wing to machine-shop (September 7, 1888)			68,340.47
For building for quarters for civil engineer (September 7, 1888			10,000.00
For reconstructing building No. 7 (September 7, 1888)			60,000.00
Navy-yard, League Island, Pa.:			
For dwellings B and C (submitted)	15,000.00		
For dwellings D and E (submitted)	15,000.00		
For landing-wharf, foot of Fifteenth street, dimensions 75 by 400 feet (submitted)	26,416.40		
For dredging and filling in (submitted)	155,000.00		
		211,416.40	
For timber dry-dock (September 7, 1888)			550,000.00
For repairs and improvement of grounds and construction of protection wall (September 7, 1888)			75,000.00
Navy-yard, Washington, D. C.:			
For extension of the yard wall (submitted)	21,711.00		
		21,711.00	
For electric alarms, time signals, and watchman detectors (September 7, 1888)			1,000.00
Navy-yard, Norfolk, Va.:			
For extension of quay wall (submitted)	150,000.00		
For two officers' quarters (submitted)	16,000.00		
For fitting out basin (submitted)	100,000.00		
		266,000.00	
For iron and steel shop (September 7, 1888)			75,000.00
For railroad extension (September 7, 1888)			10,000.00
For boiler-shop extension (September 7, 1888)			14,488.00
For water system (September 7, 1888)			15,000.00
Navy-yard, Mare Island, Cal.:			
For boat landing (submitted)	5,000.00		
For iron-plating shop (submitted)	5,755.40		
For roads (submitted)	15,000.00		
For gate and guard-house (submitted)	10,000.00		
For extension of quay wall (submitted)	110,000.00		
For one 12-ton swinging crane, submitted (September 7, 1888)	4,000.00		4,000.00

Estimates of appropriations required for the service of the fiscal year, etc.—**Continued.**

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Total amount to be appropriated under each head of appropriation.	Amount appropriated for the current fiscal year ending June 30, 1889.
NAVY-YARDS AND STATIONS—continued.			
Navy-yard, Mare Island, Cal.—Continued.			
For continuing work on granite dry-dock, to be available immediately (submitted)	$80,000.00		
For gas holder (submitted)	16,664.09		
For sectional dock basin (submitted)	30,947.84		
		$277,367.33	
For finishing boiler and machine-shop (September 7, 1888)			$4,200.00
For extending wharf from coal-house to foundry (September 7, 1888)			30,000.00
For crane-scow (September 7, 1888)			7,000.00
For mud-scow (September 7, 1888)			4,500.00
For pile-driver (September 7, 1888)			5,000.00
Naval station, Port Royal, S. C.:			
For officers' quarters (submitted)	2,000.00		
		2,000.00	
For fencing (September 7, 1888)			228.00
For artesian well (September 7, 1888)			1,000.00
For boat-house (September 7, 1888)			400.00
Electric lighting at navy-yards:			
For the establishment of plant and the inauguration of electric lighting in the navy-yards at New York, N. Y., Norfolk, Va., and Mare Island, Cal. (submitted)	45,000.00		
		45,000.00	
Selection of locations for navy-yards upon Gulf of Mexico, etc., and on the Pacific coast:			
For expenses of commission of three officers and for sounding, surveying, and making estimates for location of navy-yard on or near the Gulf of Mexico (September 7, 1888)			10,000.00
For expenses of commission to select suitable site for a navy-yard on the Pacific coast north of 42° N. latitude (same act)			5,000.00
Adjustable stern-dock:			
For one adjustable stern-dock, to be constructed at such place as the Secretary of the Navy may determine (same act)			30,000.00
		1,081,248.98	1,017,156.47
Naval station, Key West, Fla.:			
For two houses for officers' quarters (submitted)	8,000.00	8,000.00	
		1,089,248.98	1,017,156.47
CIVIL ESTABLISHMENT.			
Naval station, Sackett's Harbor, N. Y.:			
One ship-keeper, at $1 per diem* (September 7, 1888)	365.00		
		365.00	
Navy-yard, League Island, Pa.:			
One clerk to yards and docks, at $1,400 per annum (same act)	1,400.00		
One messenger to commandant, at $2 per diem, increase of 24 cents, submitted (same act)	626.00		
One foreman laborer, at $4 per diem (same act)	1,252.00		
		3,278.00	
Navy-yard, Washington, D. C.:			
One clerk to yards and docks, at $1,400 per annum (same act)	1,400.00		
One messenger, at $1.76 per diem (same act)	550.88		
One foreman laborer, at $4 per diem (same act)	1,252.00		
One draughtsman, at $4 per diem† (submitted)	300.00		
One messenger to commandant, at $2 per diem (submitted)	626.00		
		4,128.88	
Navy-yard, Norfolk, Va.:			
One clerk to yards and docks, at $1,400 per annum (September 7, 1888)	1,400.00		
One writer, at $1,017.25 per annum (same act)	1,017.25		
One messenger, at $2 per diem* (same act)	730.00		
One foreman laborer, at $4 per diem (same act)	1,252.00		

* Including Sundays. † Seventy-five days.

Estimates of appropriations required for the service of the fiscal year, etc.—Continued.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Total amount to be appropriated under each head of appropriation.	Amount appropriated for the current fiscal year ending June 30, 1889.
CIVIL ESTABLISHMENTS—continued.			
Navy-yard, Norfolk, Va.—Continued.			
One messenger, at $2 per diem (same act)	$626.00		
One messenger, at $2 per diem (same act)	626.00		
One pilot, at $2.26 per diem (same act)	707.38		
One draughtsman, at $4 per diem (submitted)	1,252.00		
		$7,610.63	
Navy-yard, Portsmouth, N. H.:			
One clerk to yards and docks, at $1,400 per annum (same act)	1,400.00		
One mail messenger, at $600 per annum (same act)	600.00		
One messenger, at $600 per annum (same act)	600.00		
One foreman laborer and head teamster, at $4 per diem* (same act)	1,460.00		
One pilot (same act) at $3 per diem, daily*	1,095.00		
One janitor (same act) $600 per annum	600.00		
		5,575.00	
Navy-yard, Boston, Mass.:			
One clerk to yards and docks, at $1,400 per annum (same act)	1,400.00		
One foreman laborer, at $4 per diem (same act)	1,252.00		
One messenger to commandant, at $1.76 per diem (same act)	550.88		
One messenger to yards and docks, at $1.76 per diem (same act)	550.88		
One mail messenger, at $600 per annum (same act)	600.00		
		4,353.76	
Navy-yard, Brooklyn, N. Y.:			
One clerk to yards and docks, at $1,400 per annum (same act)	1,400.00		
One writer, at $1,017.25 per annum (same act)	1,017.25		
One foreman laborer, at $4.50 per diem (same act)	1,408.50		
One messenger to commandant, at $2.50 per diem* (same act)	912.50		
One messenger to captain, at $2.25 per diem (same act)	704.25		
One messenger to yards and docks, at $2 per diem (same act)	626.00		
One mail messenger, at $600 per annum (same act)	600.00		
One draughtsman, at $5 per diem (same act)	1,565.00		
One quarterman, at $4 per diem (same act)	1,252.00		
		9,485.50	
Navy-yard, Pensacola, Fla.:			
One clerk to yards and docks, $1,200 per annum (same act)	1,200.00		
One mail messenger, $600 per annum (same act)	600.00		
One lamp-lighter, $550 per annum (submitted)	550.00		
		2,350.00	
Navy-yard, Mare Island, Cal.:			
One clerk to yards and docks, at $1,400 per annum (same act)	1,400.000		
One writer, at $1,017.25 per annum (same act)	1,017.25		
One foreman mason, at $6 per diem (same act)	1,878.00		
One foreman laborer, at $5.50 per diem (same act)	1,721.50		
One pilot, at $4.80 per diem (same act)	1,502.40		
One draughtsman, at $5 per diem (same act)‡	1,565.00		
One mail messenger, at $2.74 per diem (same act)	1,000.10		
One messenger, at $2.20 per diem (same act)	688.60		
One messenger and lamp-lighter, at $2.20 per diem (same act)	688.60		
One bell-ringer, at $2.26 per diem (same act)	707.38		
		12,168.83	$46,580.70
		49,495.60	46,580.70

*Including Sunday.
‡Services to be employed only when necessary.

No. 1.—*Report of expenditures at navy-yards, stations, and Naval Asylum for the year ending June, 30, 1888.*

Yards and stations.	Appropriations.					
	Yard improvements and Naval Asylum.	Repairs and preservation.	General maintenance.	Civil establishment.	Contingent.	Total.
Portsmouth, N. H	....	$44,285.43	$15,908.29	$4,954.00	....	$65,147.72
Boston, Mass	$36,593.68	33,862.90	25,171.24	3,105.25	$3,431.54	102,164.61
New London, Conn	....	295.14	4,117.80	....	....	4,412.94
New York, N. Y	205,549.20	147,284.75	36,648.82	9,347.84	4,421.85	403,252.46
League Island, Pa	....	18,832.26	12,754.94	3,284.00	....	34,871.20
Washington, D. C	....	17,222.31	12,787.80	3,069.75	12.50	33,092.36
Norfolk, Va	166,488.43	52,593.27	19,538.43	6,368.73	900.00	245,888.86
Pensacola, Fla	....	7,613.68	9,426.54	1,800.00	....	18,840.22
Mare Island, Cal	129,170.35	65,100.24	32,648.21	12,182.44	2,500.00	241,601.24
Sackett's Harbor, N. Y	....	....	21.80	366.00	....	387.80
Key West, Fla	....	1,084.79	1,307.80	....	....	2,392.59
Naval Asylum, Pa	*60,045.20	....	....	....	....	60,045.20
Wharf at Erie, Pa	....	....	....	....	500.00	500.00
Port Royal, S. C	1,692.30	105.00	944.00	....	....	2,741.30
Total	599,539.16	388,279.77	171,275.67	44,478.01	11,765.89	1,215,838.50

* This amount is for the entire support of the Naval Asylum, is a separate appropriation, and placed under this head for convenience only.

No. 2.—*Detailed report from navy-yards and stations of expenditures under "repairs and preservation" during the fiscal year ending June 30, 1888.*

Objects.	Portsmouth.	Boston.	New London.	New York.	League Island.	Washington.	Norfolk.	Pensacola.	Mare Island.	Key West.	Port Royal.	Total.
Yard buildings	$2,558.53	$8,879.95	$92.14	$23,135.89	$2,422.53	$9,695.34	$20,564.09	$2,004.26	$15,580.47	$594.08	$105.00	$85,632.28
Officers' quarters	1,325.44	1,985.44	3.00	7,510.61	276.85	8,232.86	6,762.49	2,638.56	1,425.27	....	....	25,160.52
Wharves, bridges, landings, and boats	1,863.26	1,951.18	200.00	83,253.83	1,372.00	61.96	3,811.89	1,459.90	6,965.88	490.71	....	101,429.61
Roads, walks, gutters, and drains	2,567.98	1,113.33	....	10,228.19	557.55	490.37	1,300.77	53.41	12,838.99	....	....	29,150.59
Fences and walls	92.58	391.58	....	3,177.01	16.83	165.61	1,837.28	690.94	1,795.80	....	....	8,167.63
Cranes, scows, and derricks	3,169.38	700.00	....	4,026.54	398.11	20.72	141.13	....	622.63	....	....	9,078.51
Furnaces, forges, heating apparatus, etc	2,667.56	1,521.58	....	365.86	259.88	489.17	355.55	39.87	875.92	....	....	6,575.39
Tracks and scales	18.26	12.50	....	279.00	12.00	656.70	....	4.00	3,697.36	....	....	4,679.82
Water and gas works	3,490.46	4,587.13	....	1,782.55	41.59	1,176.37	2,852.41	4.50	9,867.52	....	....	23,802.53
Dredging and scowing	....	....	....	1,722.60	....	172.58	45.00	....	....	....	....	1,940.18
Dry-docks	*22,748.20	9,485.18	....	1,689.92	....	....	3,069.83	250.77	†6,705.79	....	....	43,949.69
Miscellaneous repairs	3,783.78	3,235.03	....	10,112.75	302.47	1,060.63	11,853.33	467.47	4,725.11	....	....	35,630.57
Repairs to dikes	....	....	....	....	13 082.45	....	....	....	....	....	....	13,082.45
	44,285.43	33,862.90	295.14	147,284.75	18 832.26	17,222.31	52,593.27	7,613.68	65,100.24	1,084.79	105.00	388,279.77

* Balance dock. † Sectional dock.

No. 3.—*Detailed report of expenditures under "General maintenance" received from yards and stations during the fiscal year ending June 30, 1888.*

Objects.	Portsmouth.	Boston.	New London.	New York.	League Island.	Washington.	Norfolk.	Pensacola.	Mare Island.	Key West.	Sackett's Harbor.	Port Royal.	Total.
Freight and transportation	$2.45	$12.00	$0.40	$628.00	$0.80	$53.09	....	$0.65	$1,732.48	....	....	....	$2,429.37
Printing, stationery, and advertising	....	158.10	14.19	47.80	155.24	96.08	....	38.35	261.71	$5.63	....	....	777.10
Books, maps, models, and drawings	1.00	....	....	....	5.00	....	....	....	5.40	....	....	....	11.40
Purchase and repair of fire-engines	30.16	....	....	32.86	75.42	79.48	$129.42	58.14	13.55	....	....	....	419.03
Machinery of every description and patent rights	....	21.39	....	1,284.64	.19	200.34	190.00	34.67	216.43	....	....	....	1,947.66
Repairs on steam-engines and attendance on same	21.79	385.40	....	112.96	8.12	32.40	572.44	13.37	29.55	....	....	....	1,176.03
Purchase and maintenance of oxen and horses, pay of hired teams, etc	2,968.58	3,127.00	350.51	4,840.86	3,784.32	2,296.05	3,617.82	1,381.86	6,272.12	....	....	$111.00	28,750.14
Carts, timber-wheels, and tools of every description	264.34	448.22	43.50	458.42	499.46	1,516.60	1,680.88	223.18	589.33	....	....	....	5,732.93
Postage on letters on public service and telegrams	124.00	20.00	6.00	16.00	12.55	12.89	60.00	....	292.00	....	....	....	543.44
Furniture for Government houses and offices in navy-yards	69.56	865.66	74.00	1,170.88	6.00	639.09	161.53	351.50	309.01	....	....	104.00	3,754.23
Coal and other fuel for yards and docks purposes	3,275.72	5,228.31	57.50	4,436.80	635.69	2,190.64	195.65	110.00	3,368.18	....	$21.80	115.00	19,635.29
Candles, oil, and gas	782.31	1,157.92	8.00	3,196.07	95.06	95.75	1,683.00	221.25	3,499.12	17.35	....	65.00	10,820.83
Cleaning and clearing up yards and care of buildings	318.42	2,884.17	690.00	858.64	667.86	4,344.95	2,227.57	1,546.00	2,802.25	....	....	549.00	16,888.86
Attendance on fires, lights, fire-engines, and apparatus	1,019.58	52.11	....	4,190.20	2,512.50	294.79	1,366.91	2,052.89	1,714.28	....	....	....	13,203.26
Incidental labor, not chargeable to other appropriations	3,365.76	1,597.27	628.00	3,800.95	185.40	853.17	....	....	2,290.88	4.00	....	....	12,725.43
Water tax	....	3,774.91	25.00	5,402.99	....	....	31.76	117.60	4,792.26	25.70	....	....	14,170.22
Tolls and ferriage	.27	....	....	273.75	....	....	236.77	56.00	2,470.00	....	....	....	3,036.79
Pay of watchman	3,650.00	5,402.16	2,196.00	5,855.00	1,464.00	....	7,375.68	3,204.00	1,989.00	1,245.00	....	....	32,380.84
Flags, awnings, and packing-boxes	14.35	36.62	24.70	42.00	72.83	82.48	....	14.06	.66	10.12	....	....	297.82
Rent of officers' quarters, Philadelphia, Pa	....	....	....	....	2,575.00	....	....	....	....	....	....	....	2,575.00
Total	15,908.29	25,171.24	4,117.80	36,648.82	12,754.94	12,787.80	19,538.43	9,426.54	32,648.21	1,307.80	21.80	944.00	171,275.67

No. 4.—*Estimates received from navy-yards, stations, and Naval Asylum for fiscal year ending June 30, 1890.*

Yards and stations.	Appropriations.				
	Yard improvements and Naval Asylum.	Repairs and preservation.	General maintenance.	Civil establishment.	Total.
Portsmouth, N. H.	$12,430.00	$27,750.00	$16,357.00	$5,755.00	$62,292.00
Boston, Mass.	311,544.52	264,850.00	39,077.40	7,499.50	622,971.42
New London, Conn.		7,025.00	4,920.00		11,945.00
New York, N. Y.	778,795.00	372,340.00	85,600.00	14,347.25	1,251,082.25
League Island, Pa.	335,476.27	108,577.40	48,923.86	10,969.25	503,946.78
Washington, D. C.	21,711.00	71,700.00	21,890.00	4,128.88	119,429.88
Norfolk, Va.	626,626.00	62,062.76	63,182.80	9,253.88	761,125.44
Pensacola, Fla.		78,756.82	21,725.83	2,350.00	102,832.65
Mare Island, Cal.	503,127.63	96,547.40	53,150.00	13,464.44	666,289.47
Sackett's Harbor, N. Y.		1,000.00			1,000.00
Key West, Fla.	28,000.00	4,257.50	1,582.25		33,839.75
Naval Asylum, Pa.	80,125.00				80,125.00
Port Royal, S. C.	3,000.00	315.00	1,272.50		4,587.50
Total	2,700,835.42	1,095,181.88	357,681.64	67,768.20	4,221,467.14

No. 5.—*Detailed estimates from yards and stations for works of improvement for the fiscal year ending June 30, 1890.*

Yards, stations, and objects.	Estimates.	Total.
PORTSMOUTH, N. H.		
For water supply	$6,350.00	
For hydrant system	6,080.00	
		$12,430.00
BOSTON, MASS.		
For iron-platers' shop	120,713.89	
For cart shed	10,408.45	
For paving and grading	43,109.40	
For erecting and copper shop	39,864.90	
For officers' quarters, L. M. N. and O	28,610.00	
For timber wharf No. 5	25,389.25	
For electric-light plant	10,498.63	
For sheers	7,950.00	
For dry-dock	25,000.00	
		311,544.52
NEW YORK, N. Y.		
For repairs to Cob dock	78,375.00	
For improving Whitney basin	334,420.00	
For general paint and oil store	85,000.00	
For railroad bridge to Cob dock and extension of railroad	75,000.00	
For boat-builders' shop	75,000.00	
For railroad throughout the yard	50,000.00	
For new pumping-engines	40,000.00	
For new iron caisson	35,000.00	
		778,795.00
LEAGUE ISLAND, PA.		
For office building for yard paymaster	19,579.29	
For office building for medicine and surgery	19,579.29	
For office building for commandant	53,735.59	
For dwellings B and C	30,582.85	
For dwellings D and E	30,582.85	
For landing-wharf foot of 15th street, dimensions 75 by 100	26,416.40	
For dredging and filling in	155,000.00	
		335,476.27
WASHINGTON, D. C.		
For extension of the yard wall	21,711.00	
		21,711.00
NORFOLK, VA.		
For extension of quay-wall	230,640.00	
For paint shop	32,986.00	
For saw-mill	47,000.00	
For two (2) quarters for officers	16,000.00	
For filling out basin	300,000.00	
		626,626.00

No. 5.—*Detailed estimates from yards and stations for works of improvement, etc.*—Cont'd.

Yards, stations, and objects.	Estimates.	Total.
MARE ISLAND, CAL.		
For iron plating shop	$5,755.40	
For timber shed	57,760.30	
For rolling-mill for steam-engineering	40,000.00	
For boat-landings	5,000.00	
For roads	25,000.00	
For gate and guard-house	20,000.00	
For gas-holder	16,664.09	
For extension of quay wall	210,000.00	
For erection of 3 12-ton swinging cranes along the water-front	12,000.00	
For removal and reconstruction of ferry-slip and return-wall, sectional dock basin	30,947.84	
For continuing work on granite dry-dock	80,000.00	
		$503,127.63
KEY WEST, FLA.		
For purchase of Mallory lot	20,000.00	
For two (2) houses for officers' quarters	8,000.00	
		28,000.00
PORT ROYAL, S. C.		
For telegraph line	1,000.00	
For house for other officer	2,000.00	
		3,000.00
NAVAL ASYLUM, PHILADELPHIA.		
For support of beneficiaries, improvements, and all expenses		80,125.00
Total improvements		2,700,835.42

estimates from navy-yards and stations for "repairs and preservation" for the fiscal year ending June 30, 1890.

Objects.	Portsmouth.	Boston.	New London.	New York.	League Island.	Washington.	Norfolk.	Pensacola.	Mare Island.	Sackett's Harbor.	Key West.	Port Royal.	Total.
Yard buildings	$4,500.00	$150,000.00	$500.00	$116,350.00	$16,485.30	$20,000.00	$30,035.31	$12,759.72	$18,547.40	....	$2,742.50	$50.00	$371,970.23
Officers' quarters	1,400.00	4,850.00	500.00	4,000.00	1,063.25	2,000.00	1,764.00	7,098.07	4,950.00	....	....	25.00	27,650.32
Wharves, bridges, landings, and boats	2,000.00	16,500.00	5,000.00	31,390.00	54,248.65	2,500.00	1,019.00	24,320.00	3,500.00	....	....	100.00	140,577.65
Roads, walks, gutters, and drains	1,800.00	18,000.00	150.00	155,000.00	601.00	7,000.00	7,430.80	1,580.00	8,000.00	....	....	25.00	199,586.80
Fences and walls	450.00	6,000.00	500.00	13,300.00	291.20	700.00	4,713.65	3,115.51	2,000.00	....	....	20.00	31,090.36
Cranes, scows, and derricks	150.00	10,000.00	....	15,600.00	3,700.00	500.00	4,000.00	1,107.12	350.00	....	....	25.00	35,432.12
Furnaces, forges, heating apparatus, etc	3,000.00	4,000.00	175.00	1,800.00	558.00	5,000.00	500.00	563.09	1,600.00	....	....	20.00	17,216.09
Tracks and scales	50.00	5,500.00	....	4,900.00	1,630.00	5,500.00	100.00	....	600.00	....	....	50.00	18,330.00
Water and gas works	5,000.00	5,000.00	....	10,000.00	....	2,500.00	800.00	699.33	3,000.00	....	....	....	26,999.33
Dredging and scowing	....	10,000.00	....	15,000.00	....	25,000.00	7,600.00	15,720.00	....	....	....	....	73,320.00
Dry-docks	*8,000.00	25,000.00	....	....	....	....	2,600.00	10,545.00	†50,000.00	....	....	....	96,145.00
Miscellaneous repairs	1,400.00	10,000.00	200.00	5,000.00	....	1,000.00	1,500.00	1,248.98	*4,000.00	$1,000.00	....	....	25,348.98
Dikes	....	....	....	....	30,000.00	....	....	....	....	....	....	....	30,000.00
Cistern	....	....	....	....	....	....	....	....	....	....	1,515.00	....	1,515.00
	27,750.00	264,850.00	7,025.00	372,340.00	108,577.40	71,700.00	62,062.76	78,756.82	96,547.40	1,000.00	4,257.50	315.00	1,095,181.88

* Balance dock.

† Sectional dock.

No. 7.—*Detailed Estimate for "General maintenance" received from yards and stations for the fiscal year ending June 30, 1890.*

Objects.	Portsmouth.	Boston.	New London.	New York.	League Island.	Washington.	Norfolk.	Pensacola.	Mare Island.	Key West.	Port Royal.	Total.
Freight and transportation	$20.00	$200.00	$10.00	$1,000.00	$150.00	$20.00	$100.00	$25.00	$3,000.00	$100.00	....	$4,625.00
Printing, stationery, and advertising	200.00	350.00	75.00	500.00	1,200.00	500.00	500.00	197.50	1,000.00	15.00	....	4,537.50
Books, maps, models, and drawings	....	100.00	....	1,000.00	550.00	50.00	1,095.00	....	100.00	....	....	2,895.00
Purchase and repair of fire-engines	150.00	....	....	3,000.00	336.20	500.00	2,000.00	2,346.25	300.00	....	$25.00	8,657.45
Machinery of every description and patent rights	75.00	1,000.00	....	8,000.00	1,755.00	500.00	4,000.00	465.80	1,500.00	....	....	17,295.80
Repairs on steam-engines and attendance on same	75.00	500.00	....	5,000.00	1,212.20	1,000.00	6,000.00	368.60	6,000.00	....	....	20,155.80
Purchase and maintenance of oxen and horses, pay of hired team, etc	3,000.00	7,000.00	350.00	10,000.00	9,855.00	5,000.00	9,000.00	1,554.50	10,000.00	....	150.00	55,909.50
Carts, timber-wheels, and tools of every description	300.00	2,000.00	150.00	5,000.00	5,907.76	2,000.00	6,000.00	1,301.00	700.00	....	100.00	23,458.76
Postage on letters on public service and telegrams	125.00	50.00	15.00	100.00	150.00	20.00	100.00	....	300.00	....	....	860.00
Furniture for Government houses and offices in navy-yards	400.00	1,200.00	500.00	5,000.00	2,390.00	2,500.00	7,000.00	2,133.84	3,000.00	....	100.00	24,223.84
Coal and other fuel for yards and docks purposes	2,500.00	3,500.00	60.00	6,000.00	3,400.00	2,000.00	1,000.00	143.00	3,000.00	....	200.00	21,803.00
Candles, oil, and gas	600.00	1,500,00	20.00	4,000.00	216.50	1,200.00	3,000.00	381.49	4,000.00	7.50	100.00	15,025.49
Cleaning and clearing up yards and care of buildings	900.00	4,500.00	700.00	15,000.00	4,200.00	5,000.00	4,695.00	1,901.00	3,000.00	....	547.50	40,443.50
Attendance on fires, lights, fire-engines, and apparatus	1,300.00	2,500.00	....	5,000.00	4,200.00	1,000.00	2,190.00	2,582.25	3,000.00	....	....	21,772.35
Incidental labor, not chargeable to other appropriations	3,000.00	2,000.00	650.00	2,000.00	5,400.00	500.00	3,000.00	500.00	3,000.00	....	....	20,050.00
Water tax	....	5,000.00	100.00	4,000.00	....	....	1,500.00	117.60	5,000.00	54.75	....	15,772.35
Tolls and ferriage	12.00	....	....	500.00	....	....	300.00	60.00	3,000.00	....	....	3,872.00
Pay of watchmen	3,050.00	7,577.40	2,190.00	10,000.00	7,300.00	....	11,502.80	7,578.00	3,000.00	1,395.00	....	54,193.20
Flags, awnings, and packing-boxes	50.00	100.00	100.00	500.00	701.20	100.00	200.00	70.00	250.00	10.00	50.00	2,131.20
Total	16,257.00	39,077.40	4,920.00	83,600.00	48,623.86	21,890.00	63,182.80	21,725.83	53,130.00	1,582.25	1,272.50	357,681.64

Report showing amount expended during the fiscal year ending June 30, 1888, from appropriations pertaining to the Bureau of Yards and Docks, for civilians employed on clerical duty or in any other capacity than as ordinary mechanics and workingmen, at the several navy-yards, and submitting estimates for such civilian employés for the fiscal year 1890, in compliance with the third section of naval appropriation act approved January 30, 1885 (for a year of 365 days).

Navy-yards and rating, and rate of pay.	Amount paid to civilian employés during the fiscal year ending June 30, 1888.	Estimates for civilian employés for the fiscal year ending June 30, 1890. Rate of pay.	Estimates for civilian employés for the fiscal year ending June 30, 1890. Amount.
PORTSMOUTH, N. H.			
Clerk to civil engineer, at $1,400 per annum	$1,400.00	$1,400.00	$1,400.00
Mail messenger, at $600 per annum	600.00	600.00	600.00
Messenger, at $600 per annum	600.00	600.00	600.00
Foreman laborer and head teamster, at $4 per diem*	1,256.00	4.00	1,460.00
Pilot, at $3 per diem*	1,098.00	3.00	1,095.00
Janitor, at $600 per annum	....	600.00	600.00
Total	4,954.00	....	5,755.00
BOSTON, MASS.			
Clerk to civil engineer, at $1,400 per annum	1,399.91	1,400.00	1,400.00
Foreman laborer, at $4 per diem	....	4.00	1,252.00
Messenger to commandant, at $1.76 per diem	552.64	1.76	550.88
Messenger to civil engineer, at $1.76 per diem	552.64	1.76	550.88
Mail messenger, at $600 per annum	600.03	600.00	600.00
Total	3,105.25	....	4,353.76
NEW YORK, N. Y.			
Clerk to civil engineer, at $1,400 per annum	1,400.00	1,400.00	1,400.00
Writer, at $1,017.25 per annum	1,017.25	1,017.25	1,017.25
Foreman laborer, at $4.50 per diem	1,413.00	4.50	1,408.50
Mail messenger, at $600 per annum	600.00	600.00	600.00
Messenger to commandant, at $2.50 per diem*	915.00	2.50	912.50
Messenger to captain, at $2.25 per diem	704.59	2.25	704.25
Messenger to yards and docks, at $2 per diem	628.00	2.00	626.00
Draughtsman, at $5 per diem	1,570.00	5.00	1,565.00
Quarterman, at $4 per diem	1,100.00	4.00	1,252.00
Total	9,347.84	....	9,485.50
SACKETT'S HARBOR, N. Y.			
Ship-keeper, at $1 per diem*	366.00	1.00	365.00
LEAGUE ISLAND, PA.			
Clerk to civil engineer, at $1,400 per annum	1,400.00	1,400.00	1,400.00
Messenger to commandant, at $2 per diem	628.00	2.00	626.00
Foreman laborer, at $4 per diem	1,256.00	4.00	1,252.00
	3,284.00	....	3,278.00
WASHINGTON, D. C.			
Clerk to civil engineer, at $1,400 per annum	1,392.33	1,400.00	1,400.00
Messenger, at $1.76 per diem	547.36	1.76	550.88
Foreman laborer, at $3.50 per diem	1,130.06	4.00	1,252.00
Draughtsman, at $4 per diem†	....	4.00	300.00
Messenger to commandant, at $2 per diem	....	2.00	626.00
	3,069.75	....	4,128.88
NORFOLK, VA.			
Clerk to civil engineer, at $1,400 per annum	1,399.93	1,400.00	1,400.00
Writer, at $1,017.25 per annum	1,017.16	1,017.25	1,017.25
Mail messenger, at $2 per diem*	732.00	2.00	730.00
Foreman laborer, at $4 per diem	1,254.00	4.00	1,252.00
Messenger, at $2 per diem	628.00	2.00	626.00
Messenger, at $2 per diem	628.00	2.00	626.00
Pilot, at $2.26 per diem	769.64	2.26	707.38
Draughtsman, at $4 per diem	....	4.00	1,252.00
	6,368.73	....	7,610.63

* Including Sundays. † For seventy-five days.

Report showing amount expended during the fiscal year ending June 30, 1888, from appropriations pertaining to the Bureau of Yards and Docks, etc.—Continued.

Navy-yards and rating, and rate of pay.	Amount paid to civilian employés during the fiscal year ending June 30, 1888.	Estimates for civilian employés for the fiscal year ending June 30, 1890. Rate of pay.	Amount.
PENSACOLA, FLA.			
Clerk to civil engineer, at $1,200 per annum	$1,200.00	$1,200.00	$1,200.00
Mail messenger, at $600 per annum	600.00	600.00	600.00
Lamplighter, at $550 per annum	....	550.00	550.00
	1,800.00	....	2,350.00
MARE ISLAND, CAL.			
Clerk to civil engineer, at $1,400 per annum	1,400.00	1,400.00	1,400.00
Writer, at $1,017.25 per annum	1,017.16	1,017.25	1,017.25
Foreman mason, at $6.00 per diem *	1,878.00	6.00	1,878.00
Foreman laborer, at $5.50 per diem	1,716.00	5.50	1,721.50
Pilot, at $4.80 per diem	1,507.20	4.80	1,502.40
Draughtsman, at $5.00 per diem †	1,570.00	5.00	1,565.00
Mail messenger, at $2.74 per diem ‡	1,002.84	2.74	1,000.10
Messenger, at $2.20 per diem	690.80	2.20	688.60
Messenger and lamplighter, at $2.20 per diem	690.80	2.20	688.60
Bell-ringer, at $2.26 per diem	709.64	2.26	707.38
	12,182.44	....	12,168.83

* Including Sundays. † Services to be employed only when necessary. ‡ Mail messenger employed Sundays.

Recapitulation of expenditures for civilian employés for fiscal year ending June 30, 1888, and estimates for the same for fiscal year ending June 30, 1889, per act approved January 30, 1885.

Navy-yards.	Expenditures, 1887-'88.	Estimates, 1889-'90.
Portsmouth, N. H	$4,954.00	$5,755.00
Boston, Mass	3,105.25	4,352.75
Brooklyn, N. Y	9,347.84	9,485.50
Sackett's Harbor, N. Y	366.00	365.00
League Island, Pa	3,284.00	3,278.00
Washington, D. C	3,069.75	4,128.88
Norfolk, Va	6,368.73	7,610.63
Pensacola, Fla	1,800.00	2,350.00
Mare Island, Cal	12,182.44	12,168.83
Total	44,478.01	49,495.00

Statement of the appropriations for the Bureau of Yards and Docks for the fiscal year ending June 30, 1888, showing the amounts expended under each specific head of appropriation and the balances remaining unexpended June 30, as required by section 429 Revised Statutes.

Appropriations for general maintenance, 1888	$170,000.00
Expended from July 1, 1887, to June 30, 1888	154,969.50
Balance on hand July 1, 1888	15,030.50
A small balance of the above will revert to the Treasury.	
Appropriation for repairs and preservation, 1888	450,000.00
Expended from July 1, 1887, to June 30, 1888	408,693.64
Balance on hand July 1, 1888	41,306.36
About $10,000 of the balance will revert to the Treasury.	
Appropriation for civil establishment, 1888	45,893.09
Expended from July 1, 1887, to June 30, 1888	44,398.80
Balance on hand July 1, 1888	1,494.29
About $1,400 of the balance will revert to the Treasury.	
Appropriation for contingent, 1888	20,000.00
Expended from July 1, 1887, to June 30, 1888	8,861.15
Balance on hand July 1, 1888	11,138.85
of which about $8,500 will revert to the Treasury.	
Appropriation for navy-yard, Boston, Mass.:	
Rebuilding wharves	25,000.00
Expended from July 1, 1887, to June 30, 1888	24,922.73
Balance on hand July 1, 1888	77.27
Balance will be entirely absorbed.	
Appropriation for navy-yard, Boston:	
Rebuilding floating gate	31,000.00
Expended from July 1, 1887, to June 30, 1888	11,854.33
Balance on hand July 1, 1888	19,145.67
About $18,000 will revert to the Treasury.	
Appropriation for timber dry-docks, navy-yards Brooklyn and Norfolk	1,100,000.00
Expended from July 1, 1887, to June 30, 1888	302,468.75
Balance on hand July 1, 1888	797,531.25
which will be expended in completing the docks.	
Appropriation for navy-yard, Norfolk:	
Railroad extension	20,000.00
Expended from July 1, 1887, to June 30, 1888	3,330.23
Balance on hand July 1, 1888	16,669.77
Balance will be entirely absorbed in completing the improvement.	
Appropriation for navy-yard, Mare Island, Cal.:	
Cisterns	46,364.00
Expended from July 1, 1887, to June 30, 1888	39,847.69
Balance on hand July 1, 1888	6,516.31
Balance will be entirely absorbed in completing the cisterns.	
Appropriation for naval asylum, Philadelphia, 1888:	
Amount	63,167.00
Expended from July 1, 1887, to June 30, 1888	43,813.78
Balance on hand July 1, 1888	19,353.22
After outstanding liabilities are paid a small balance will revert to the Treasury.	

Appropriation for navy-yard, Brooklyn, N. Y., 1887:

Repairing granite dock	$100,000.0[illegible]
Expended from July 1, 1886, to June 30, 1888	87,429.3[illegible]
Balance on hand July 1, 1888	12,570.6[illegible]

which will be expended in completing the necessary repairs.

Appropriation for navy-yard, Mare Island, Cal., 1887:

Granite dry-dock	191,595.0[illegible]
Expended from July 1, 1886, to June 30, 1888	144,935.9[illegible]
Balance on hand July 1, 1888	46,659.[illegible]

which will be entirely absorbed.

Appropriation for navy-yard, Mare Island, 1886:

Granite dry-dock	220,000
Expended from July 1, 1885, to June 30, 1888	220,000.[illegible]

Appropriation for navy-yard, Mare Island, 1886:

Artesian well	10,000.[illegible]
Expended from July 1, 1885, to June 30, 1888	5,406.[illegible]
Balance on hand July 1, 1888	4,594.[illegible]

which will be absorbed if well is completed.

Appropriation for naval station and coaling depot, Port Royal, S. C.:

Coaling dock and naval storehouse	$24,000.[illegible]
Expended from July 1, 1884, to June 30, 1888	23,807.[illegible]
Balance on hand July 1, 1888	192.[illegible]

which will revert to the Treasury.

No. 5.—BUREAU OF EQUIPMENT AND RECRUITING.

NAVY DEPARTMENT,
BUREAU OF EQUIPMENT AND RECRUITING,
Washington, September 1, 1888.

SIR: I have the honor to submit the following report of the operations of this Bureau for the fiscal year ending June 30, 1888, and with this report I would respectfully transmit the estimates reported necessary for the fiscal year ending June 30, 1890.

For the year ending June 30, 1888, the following amounts were appropriated under the several headings, viz:

Equipment of vessels	$625,000
Transportation and recruiting	25,000
Contingent	15,000
Civil establishment	11,525
Training station (for apprentices) Coaster's Harbor Island	14,000

There was expended at the several yards, to partially or wholly refit vessels and to supply them with the necessary stores, $45,646.54 for labor, and $165,579.24 for material, aggregating $211,225.78 from the appropriation "Equip ment of vessels."

I have the honor to report that all appropriations for this year have been found sufficient, and in some there are unexpended balances to revert to the Treasury. That for transportation was not equal to the demands, therefore a small deficiency of about $2,000 is reported, in accordance with section 3722 of the Revised Statutes, which authorizes a deficiency "not to exceed the necessities of the current year."

For the supply of vessels on home and foreign service, 58,110 tons of coal were purchased, costing, including the necessary expenses of handling, $265,005.05. The price paid for coal was slightly in advance of the preceding year; most of it, however, was delivered under contract, after the usual legal advertisement. Purchases in the open market occurred at intervals, and only when the emergency of cruising required it at ports where there was no Government supply.

WIRE.

For the manufacture of cordage needed by vessels in commission or in being put into commission, or for the cruisers building, and at stations, the following amounts were purchased:

Kind.		Quantity.	Value.
Steel	Pounds	43,204	$2,919.66
Iron	do	988	59.00
Copper	do	69	3.80

ROPE-WALK.

During the fiscal year the following amounts of cordage were manufactured at the Boston yard, costing, including labor:

203,224 pounds manilla cordage	$26,419.12
169,892 pounds hemp cordage	21,798.38
12,034 pounds steel cordage	2,286.46
97 pounds copper rope	58.20
1,348 pounds small stuff (seizings, etc.)	553.32

The prices paid have varied but little since my last annual report, hence the cost of production has been maintained at market rates. During the year the Bureau has supplied the Light-House Establishment with a large amount of cordage of superior quality at ab market prices.

FORGE, ANCHOR, CHAIN, AND GALLEY SHOPS AND ROLLING-MILL.

During the year a large amount of old scrap-iron has been bloomed and converted into plate or bar for use in making chain, galleys, and anchors. As soon as the old plant at the Boston yard, turned over to this Bureau, was put to work, all defects or weaknesses developed as work of the heavier character progressed. The rolling-mill foundation was found rotten, one or two of the steam-hammers required to be reset, the fly-wheel of the cutting machine gave way, the driving engines were lined up, the blast furnaces were enlarged, and other improvements needed were made as the exigencies of work developed the necessity. Notwithstanding this, the output has been quite equal to the demand, while the character of the work has been much better and more satisfactory than ever before. Each day goes to show the wisdom of this concentration of the Bureau's manufactories in one yard. The general result has been the improved condition of work with greater production of it. The Bureau expresses the greatest satisfaction with the change, and with the foremen and workmen who have brought it about so successfully.

The following will exhibit the output of each establishment:

Rolling-Mill:	
229,831 pounds chain-iron	6,889.93
5,627 pounds bar-iron	175.55
Total cost	7,065.48
Forge and Anchor Shop:	
27,406 pounds iron forgings	4,110.90
7 anchors	5,344.57
Total cost	9,455.47
Galley Shop:	
Two galleys, No. 2	4,516.80
One galley, No. 3	1,365.53

Repairs of greater or less extent were made to the galleys of the *Wabash*, *Portsmouth*, *Mahopac*, *Boston*, *Chicago*, *Pinta*, *Vermont*, *Richmond*, *Trenton*, *Swatara*, *Galena*, *Omaha*, *Kearsarge*, *Baltimore*, *Michigan*, *Marion*, *Charleston*, and *Saratoga*, costing $20,993.48.

The Bureau is substituting a new galley, made at the Boston yard, for the old Young's galley formerly used on board our vessels. This was found necessary, in view of the fact that the old boiling system of the

Young's galley had been retained as a whole, while the new rations of the men demanded improved and more extended means of boiling, baking, roasting, or frying. The necessity for compactness and contraction in the cooking arrangements of the new ships building being also of such importance, the Bureau has adopted a new galley in which all the conditions needed are obtained.

SMITH AND CHAIN SHOPS.

But few chains of the smaller sizes have been made during this year, and those only for the new cruisers, and which were not in hand in stock. That which has been made, however, is rather superior in grade and other qualities to any made heretofore. The Bureau's experience bears out the statement that better and cheaper work is done under the present arrangements than under the old plan.

SAIL LOFTS.

The making of sails, awnings, hammocks, bags, hammock cloths, and other canvas work has been concentrated at the Boston yard. The following expenditures were made there, as well as for minor repairs at other yards when the cost of transportation to Boston would have been too great to justify it:

For material	$27,101.75
For labor	34,031.12

RIGGING LOFTS.

As in the case of the sail lofts, the work of fitting rigging, repairing rigging, etc., is concentrated at Boston, and the following expenditures were necessary:

For material	$15,661.54
For labor	24,623.96

ENLISTED MEN.

On June 30, 1888, there were 8,354 men and apprentices in the service. The average number allowed by law has not been exceeded during the year.

Men allowed	7,500
Men enlisted at different rendezvous	2,348
Men enlisted on board ships	2,436
Discharges during the year	3,680
Honorably discharged and continuous service men in Navy during the year	2,075
Desertions during the year	1,121
Deaths during the year	55
Men employed in Coast Survey	275
Men employed at Naval Academy during winter	94
Men employed at Naval Academy during summer	269
Number of men enlisted, formerly apprentices	59
Number of men enlisted under continuous service certificate	552
Cost of maintaining men in Coast Survey	$137,374.56
Cost of maintaining men in Fish Commission	$64,046.93

During the year inspections were made of all the receiving-ships except the *Independence* at Mare Island. The condition of order and cleanliness was noticeably excellent and reflected much credit upon the commanding and other officers. Care is exercised to enlist in accord-

ance with the regulations prescribed by the Department. All the officers employed on the recruiting service are men of judgment and much interested in their duties.

The men are well-behaved, and, as a rule, orderly. During the year the vessels engaged in recruiting service were stationed and commanded as follows: U. S. R. S. *Wabash*, Captain C. C. Carpenter, Boston, Mass.; U. S. R. S. *Vermont*, Captain W. A. Kirkland, Brooklyn, N. Y.; U. S. R. S. *St. Louis*, Captain William Whitehead, Philadelphia, Pa.; U. S. R. S. *Dale*, Commander Yates Sterling, Washington D. C.; U. S. R. S. *Franklin*, Captain A. P. Cooke, Norfolk, Va.; U. S. R. S. *Independence*, Commander J. W. Philip, Mare Island, California.

All these vessels were at one time in active service as cruising ships, but were withdrawn when the expense of repair was too great to justify the expenditure. Most of them are covered in and otherwise fitted, and permanently moored alongside the docks at the navy-yards where stationed.

The number of men enlisting under continuous service is larger yearly, but there yet remains much to be desired in the increase of this class. My own impression is, that more attention to the comforts of men, more regard for their future, and more consideration of their privileges when abroad in service are the means by which men are to be made contented, efficient, and attached to their profession. My own observation is that men never dislike what is called a "taut ship" if the officers are just. If they know that the commanding and executive officers are mindful and careful of their interest and considerate in granting privileges, there is nothing in the work of such ships that is not done with the highest efficiency and credit. But, as judgment is so variable, we find the greatest variety in the treatment of the minor offenses on board different ships; they often appear to differ for the same offense as widely as the stations of the ships. It is here that I would suggest for your action the propriety of calling together a board of officers to classify the minor offenses committed by men belonging to the Navy, and to prescribe what punishment should be meted out to each offense, so that uniformity will result in every ship. Punishment inflicted when the officer is excited is apt to be unfair, but it is much more unfair to the man when the punishment of offenses committed by him is left to the absolute discretion of commanding officers. Added to this, cheaper clothing, better food, more healthful sleeping accommodations, with better light and better ventilation are the means which must bring efficiency, contentment, and greater happiness.

ADDITIONAL COURSE OF INSTRUCTION FOR SEAMEN.

The great benefit accruing to the service from the training of men at Washington and at Newport is more and more apparent. The advantage to the Navy of having some men in the crew of each vessel acquainted with the modern means of offense and the methods of preparing and handling the new machines can not be overstated. The gratifying fact to the Bureau is that more applications are made for this instruction than can be granted, which indicates the appreciation held by the men of the advantage given them by this course of training. Reports from both Washington and the Torpedo Station show that the men under instruction are highly interested, efficient, and skillful. As the new ships now building come into service, the advantage of this training will be more apparent. Commander Goodrich, at the Torpedo Station, has been most interested in the instruction of these men at the

station, and the Bureau would fail in a pleasing duty if it omitted this acknowledgment.

TRAINING APPRENTICES FOR THE NAVY.

Coaster's Harbor Island.—This permanent headquarters of the training service has been for the past year under the command of Commander F. J. Higginson, U. S. Navy, a most able and efficient officer, whose untiring interest in all that relates to the training and care of apprentices is to be highly commended by the Bureau. I think the time has passed to defend the system of training apprentices; the yearly progress in all matters on board ships relating to naval service in every branch must certainly prove that preliminary instruction in the duties of seamen is indispensably needed. This establishment, therefore, is a great nursery upon which we are to depend for trained seamen in the future. The course of instruction is so arranged as to include some training in all branches taught practically at the headquarters. This training, supplemented by that in the cruising training ships for a period of six months, is sufficient to equip the lad for usefulness on board the cruiser of the general service, where he is always found proficient and reliable in performing duties. The Bureau has in course of preparation new regulations for this training service, with a view to secure more uniformity throughout the service, touching the instruction and management of the lads, as well as to correct some inequalities which occasionally exist in their special ratings after leaving the training ships.

There are a number of vessels engaged in the enlistment of apprentices, and are stationed and commanded as follows: U. S. R. S. *Wabash*, Capt. C. C. Carpenter, Boston, Mass.; U. S. T. S. *Minnesota*, Capt. G. C. Wiltse, New York; U. S. R. S. *St. Louis*, Capt. William Whitehead, Philadelphia; U. S. R. S. *Dale*, Commander Yates Stirling, Washington; U. S. S. *Michigan*, Commander H. F. Picking, on the Lakes; U. S. T. S. *New Hampshire*, Commander F. J. Higginson, Newport, R. I.

Except on the *New Hampshire*, as soon as these lads are enlisted they are transferred for preliminary training to Coaster's Harbor Island, where they are retained for about six months, to be taught reading, writing, and arithmetic, together with practical instructions in all the duties of the young seaman, such as sewing, handling the palm and needle, heaving the lead, reefing, furling, loosing sails, knotting and splicing, boxing the compass, as well as the infantry, howitzer, and great gun drills. Gymnastic exercises of no ordinary kind are taught all boys, as a setting-up drill to improve their carriage and general physique. A new feature in the training this year has been to set aside a number of boys whose aptitude for several trades was superior to their aptitude for a sailor's life, and these boys, in addition to their instruction in sail-making, carpentering, blacksmithing, have been taught the practical duties of the sailor, so that, in going out into service, they will carry with their trades a knowledge of the duties of the sailor. This circumstance will make them as much better than the men of the gangs into which they go as a man with two arms is likely to be better than a man with only one.

The following exhibit shows the number of apprentices in the Navy on June 30, 1888:

Number on board stationary and cruising training-ships	522
Number on board cruising ships of the general service	542
Total	1,064

Those on board the cruising ships of the general service are distributed as follows:

North Atlantic Station	166
South Atlantic Station	58
Pacific Station	146
European Station	76
Asiatic Station	96
Total	542

There were 2,072 applications for enlistment during this year; there were rejected of this number 1,284 for physical disqualifications, and 105 for other causes, leaving 683 accepted; of these, 218 failed to report after examination, so that the number actually received into service and placed under training was 465.

Cruising training-ships.—The *Jamestown* and *Saratoga* being so much out of repair, a survey was requested on each of them under the Revised Statutes. In each case the amount of repairs found necessary by the Board were so extensive that the sea-worthiness of these vessels became very doubtful. Under these circumstances their usual winter cruise to the West Indies were not made, but a cruise to Chesapeake Bay and its tributaries was substituted. The condition of *Portsmouth* being much more satisfactory, Commander E. White was ordered to cruise during the winter months among the Windward Islands of the West Indies, extending his trip as far south as Trinidad, and returning about the latter part of May to Newport, R. I. In the meanwhile, the apprentices on board the *Jamestown*, Commander C. J. Train, were transferred to the *Saratoga*, Commander C. H. Davis, and sent in that vessel to Newport, where the usual semi-annual inspection took place during the early part of June.

The inspection of the apprentices of these ships at Coaster's Harbor Island in June was extremely satisfactory, and showed evidence of proficiency that was very creditable to the officers of the ships. Soon after this inspection the Bureau recommended a complete survey of the *Portsmouth*, at the Portsmouth yard, with a view to ascertain her seaworthiness. The report of the Board showed that her condition was, in most particulars, similar to the *Saratoga* and *Jamestown*. They were accordingly recommended to be put out of commission for general repairs. The work done by these vessels was of incalculable benefit to the naval service, though it must be admitted that nothing could be learned in them of the new conditions of service now being developed in the newer vessels. As a school for gymnastic exercise or in which to afford opportunities for sea hardening they have some merit, but to no greater extent than would occur in new steam bark-rigged vessels of modern type suggested in my preceding annual reports.

Notwithstanding the difference of opinion on this subject by officers of merit and distinction in the naval service, the Bureau believes that the proper system of education to suit the new conditions of the new Navy is to begin the training of apprentices in vessels that bear some analogy to the newer implements and conditions of the vessels in which they must serve beyond the mere external likeness of ships. The older methods of rigging or handling these ships might be taught in somewhat the same way that ancient history is taught in schools, but to subordinate the training of apprentices entirely to obsolete methods, in obsolete ships, and to defer their real usefulness until they reach the new vessels, where they can be of no service and must be in their own way until they are shaken down for a few months to acquire a knowledge and adaptability to the new surroundings, appears to the Bureau

a fatal mistake. Such a system, if it means anything, forces the conclusion that every new ship going into commission must assume a condition of probation until her apprentices have been taught their new duties, made all the more difficult at the outset by prejudices imbibed in the obsolete school of training. It hardly needs argument to show how disastrous this might be during war, when vessels of war would be required to meet an enemy immediately after being equipped for service.

The vessels suggested for this service are not of special design or build, but simply two modern-built steam bark-rigged vessels capable of keeping the sea under sail, and of making passages from port to port, but which should be fitted with all modern appliances for steering, lighting, and for torpedo work, but capable of being turned into the battle lines in the event of war. It was the Bureau's purpose, with ships of this character, to include the training of men for the engineer's force, that there might be developed at the outset of a cruise, or in steam trials, the fullest capacity and power of the new engines and boilers now found in all our modern vessels.

PENSIONS.

The table following presents a concise exhibit of the pension cases of men presented during the fiscal year ending June 30 to the Bureau, under the operations of sections 4756 and 4757 Revised Statutes of the United States:

	Claims pending July 1, 1887.	Claims filed year ending June 30, 1888.	Claims allowed year ending June 30, 1888.	Claims disallowed year ending June 30, 1888.	Claims pending year ending June 30, 1888.
For service of twenty years	30	43	22	6	45
For service of ten years	29	29	13	10	35
For renewal of pensions	2	16	13		5
For increase of pensions	3	8	6	3	2
For review of claims		2	1	1	
Total	64	98	55	20	87

THE NEW STEEL CRUISERS.

During the fiscal year the Bureau has had an officer employed in making new allowance tables for these new vessels, as the space available in them is so much less than in the old steam and sailing vessels they are to replace. The types of these new ships differing so much from each other has made it necessary to make special and separate allowances for each ship. Weight being an important factor in the new ships, it has been found absolutely necessary to reduce to the lowest possible limit all supplies required, in order to keep within the figures estimated at the time these ships were designed. Allowance tables, therefore, which include anchors, chains, sails, running and standing rigging, galleys furniture, mess and boat fittings, together with all the various articles of stores provided by this Bureau, have been made, with the weight of each article determined by computation or directly by scale for the following ships: U. S. S. *Yorktown*, *Baltimore*, *Charleston*, *Petrel*, *San Francisco*, *Philadelphia*, *Bennington*, and *Concord*.

These tables are sent to the Boston navy-yard, where the articles allowed are made and assembled, ready for shipment to the vessel soon as she may be in condition to receive them. In this particular the advantage of a special equipment yard is made manifest by the increased facility and reduced expenditures in fitting the different vessels.

The equipment officers are required to keep strictly within the allowance of weight given for each vessel, so that the Bureau is informed almost to the pound weight of all things manufactured and placed on vessels.

RECOMMENDATIONS.

I have referred, in my previous report, to the improved conditions of the new ships, as a means to improved comfort of the men, but in no particular is the health, happiness, and harmony of ships' companies more affected than by good and cleanly mess arrangements. At present time the Government ration is most excellent, and to meet the new conditions a new galley has been devised, with a view to amplify the means of properly cooking the men's food, but there yet remains one feature of new organization intensely defective, uncleanly, and wasteful. The Bureau has had in view a change in this particular by which many of the slovenly and incompetent mess cooks could be dispensed with, and, in their places, a reliable man or two substituted and charged more directly with providing and preparing the rations in forms more palatable and digestible. In the present organization of messes, there is nobody responsible for stores, or money paid in, for mess use, and it often happens that there is extravagant wastefulness of one, or complete loss of the other, by desertion of the caterer of the mess who has charge of commuted ration money. There is no reason why, as a matter of comfort and better government so intimately connected with the ship's efficiency, some commissioned officer of the ship should not be charged with the administration of this most important question of organization.

The Bureau would also recommend that some increase in the pay of certain grades of petty officers and other enlisted men in the Navy be allowed. The reason leading to this suggestion is that the law concerning employment in the navy-yards requires that the rates of pay in them shall be those prevailing in the private establishments in the localities about our yards. The object of this law is evident. It has become necessary to train men for special uses on board our ships of war in connection with their electric installation, for the handling of torpedoes, for diving, for the safe handling of high explosives, and for various other duties which have their value in special civil callings. Unless, therefore, these men are paid wages which correspond to those paid in civil life, we shall find that our best men, after being trained to our needs, will naturally drift away from us into civil pursuits where they would be preferred as disciplined in self-control. The pay of all other men should be somewhat nearer to that paid in the merchant marine; the Bureau would suggest somewhat higher, for the reason that the men of the Navy are required to be absent from homes for terms of three years, they are compelled to be uniformly better dressed, to be constantly under military restraint and discipline, and in the nature of their service are subjected to greater privations and exposures for longer periods of time in many of the unhealthful localities of the world. The Bureau would recommend to your consideration the schedule transmitted a short time ago with the report of the Board ordered by you to consider the matter of pay and ratings of the enlisted men of the Navy.

I would again invite attention to the act passed February 14, 1885, whereby the enlisted men of the Army and Marine Corps are permitted to retire after thirty years of service, with 75 per cent. of the pay of the rank in which retired. The law simply requires that application should be made to the President for this great benefit. This Bureau feels that the sailor should be included in this great benefit, and, to this end recommends his interest to your consideration.

Citizenship is conferred upon aliens, by section 2166 of Revised Statutes, who serve in the Army and who may be honorably discharged, at the expiration of enlistments. The men who serve in the Navy ought to be entitled to this same right, and I would respectfully invite your consideration to this matter.

The officers of the Navy are still without authority to administer the oath of allegiance to recruits, as prescribed by article 2, section 1342, of the Revised Statutes, in the case of officers of the Army. Nobody should be appointed or recruited for place in the military establishments of the Government without being obliged to take the oath of office. To enable officers of the Navy to perform this duty, the Bureau would recommend the amendment of the section to include the Navy.

Very respectfully, your obedient servant,

W. S. SCHLEY,
Chief of Bureau.

HON. WILLIAM C. WHITNEY,
Secretary of the Navy.

Estimates of appropriations required for the service of the fiscal year ending June 30 by the Bureau of Equipment and Recruiting, Navy Department.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 18[illegible]
CONTINGENT.		
For extra expenses of training ships, freight and transportation of equipment stores, printing, advertising, telegraphing, books, and models; postage on letters sent abroad; ferriage, ice, apprehension of deserters and stragglers, continuous-service certificates, good-conduct badges, and libraries for enlisted men; school-books for training ships, medals for boys, and emergencies arising under cognizance of the Bureau of Equipment and Recruiting unforeseen and impossible to classify (appropriated R. S., p. 721, sec. 3666; pamphlet edition, p. 4)	$20,000.00	$15,[illegible]
NAVAL TRAINING STATION, COASTERS' HARBOR ISLAND (FOR APPRENTICES).		
For building natatorium, dredging channels, repairs to main causeway, roads, and grounds, extending sea-wall, including the cost of purchase of such buildings and implements, and the employment of such labor as may be necessary for the proper care and preservation of the same; for repairs and improvements on buildings; heating, lighting, and furniture for same; books and stationery, freight, and other contingent expenses; purchase of food and maintenance of live stock and mail wagon, and attendance on same; for the purchase of one steam fire-engine and necessary hose, and repairs to same (appropriated; pamphlet edition, p. 5)	30,000.00	14[illegible]
EQUIPMENT OF VESSELS.		
For coal for steamers' and ships' use, including expenses of transportation, storage, and handling; hemp, wire, and other materials for the manufacture of rope and cordage; iron and steel for the manufacture of anchors, cables, galleys, and chains; canvas for the manufacture of sails, awnings, bags, and hammocks; water for steam-launches; heating apparatus for receiving ships; and for the purchase of all other articles of equipment at home and abroad, and for the payment of labor in equipping vessels and manufacture of equipment articles in the several navy-yards (appropriated; R. S., p. 733, secs. 3709, 3747; pamphlet edition, p. 4)	700,000.00	625,00[illegible]
TRANSPORTATION AND RECRUITING.		
For expenses of recruiting for the naval service; rent of rendezvous, and expenses of maintaining the same; advertising for men and boys, and all other expenses attending the recruiting for the naval service, and for the transportation of all enlisted men and boys at home and abroad (appropriated; R. S., p. 721, sec. 3666; pamphlet edition, p. 4)	30,000.00	30,00[illegible]
SALARIES.		
One chief clerk (July 11, 1888; R. S., p. 70, sec. 416; pamphlet edition, p. 30)	1,800.00	
One clerk of class four (July 11, 1888; R. S., p. 27, sec. 167; pamphlet edition, p. 30)	1,800.00	
Two clerks of class two (same acts; R. S. p. 27, sec. 167; pamphlet edition, p. 30)	2,800.00	
Three clerks of class one (same acts; R. S., p. 27, sec. 167; pamphlet edition, p. 30)	3,600.00	
Two copyists at $900 each (same acts; R. S., p. 27, sec. 167; pamphlet edition, p. 30)	1,800.00	
One assistant messenger (same acts; R. S., p. 27, sec. 167; pamphlet edition, p. 30)	720.00	
One laborer (same acts; R. S., p. 27, sec. 167; pamphlet edition, p. 30)	660.00	
One clerk of class three, to replace one of that grade transferred from this Bureau to that of Provisions and Clothing (submitted)	1,600.00	
	14,780.00	13,180
CIVIL ESTABLISHMENT.		
Navy-yard, Portsmouth, N. H.:		
One clerk (appropriated; pamphlet edition, p. 5)	1,200.00	
Navy-yard, Boston, Mass.:		
One superintendent of ropewalk (appropriated; pamphlet edition, p. 5)	1,875.00	
One clerk (appropriated; pamphlet edition, p. 5)	1,400.00	
One clerk (appropriated; pamphlet edition, p. 5)	1,300.00	
One writer (appropriated; pamphlet edition, p. 5)	950.00	

of appropriations required for the service of the fiscal year, etc.—Continued.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1889.
CIVIL ESTABLISHMENT—continued.		
ry-yard, New York:		
One clerk (appropriated; pamphlet edition, p. 5)	$1,200.00	
ry-yard, League Island, Pa.:		
One clerk (appropriated; pamphlet edition, p. 5)	1,200.00	
ry-yard, Norfolk, Va.:		
One clerk (appropriated; pamphlet edition, p. 5)	1,200.00	
ry-yard, Mare Island, Cal.:		
One clerk (appropriated; pamphlet edition, p. 5)	1,200.00	
	11,525.00	$11,525.00

Statement of sales of condemned materials under cognizance of the Bureau of Equipment and Recruiting during fiscal year ending June 30, 1888, showing the materials sold, the parties buying the same, and the amount realized therefrom.

Date of sale.	Where sold.	Materials sold.	Purchasers.	Amount realized.
1887.				
Oct. 11-12	Portsmouth	207,990 pounds scrap-iron	T. Butler & Co	$894.36
Do	...do	415,438 pounds scrap-iron	...do	1,599.44
Do	...do	Mischllaneous lot	L. E. Hunt	40.00
Do	...do	...do	Nolan Bros	75.00
Do	...do	...do	J. L. O. Coleman	20.00
Do	...do	...do	Nolan Bros	5.50
Do	...do	...do	...do	.25
Do	...do	4,180 pounds hawser	Michael Ash	151.52
Do	...do	38,270 pounds rope	S. A. Coomie	2,058.92
Do	...do	21,400 pounds rope	Michael Ash	1,091.40
Do	...do	Miscellaneous lot	E. H. Wilson & Co	2,000.00
Do	...do	20,275 pounds hemp and manila cable.	Michael Ash	871.83
Do	...do	123,810 pounds running rigging	...do	2,042.86
Do	...do	8,990 pounds old canvas rags	Martin Burke	107.88
Do	...do	11,965 pounds rope	...do	74.18
Do	...do	13,600 pounds sails	L. E. Hunt	242.08
Do	...do	10 anchors	...do	156.25
Do	...do	4 anchors	Nolan Bros	108.75
Do	...do	12 anchors	W. J. Hallett	333.50
Do	...do	4 anchors	W. J. Lynch	52.25
Do	...do	2 anchors	S. McKenna	27.75
Do	...do	1 anchor	J. Haggerty	16.00
Do	...do	3 anchors	J. Baker & Co	140.00
Do	...do	5 anchors	J. Hughes	244.50
Do	...do	7 anchors	L. F. S. Davis	322.00
Do	...do	8 anchors	J. Schrader	455.00
Do	...do	1 anchor	E. L. Fitzgerald	31.00
Do	...do	...do	F. Bannerman	18.00
	Total			13,160.22
1888.				
Mar. 6	Washington	13 awnings	D. Dreifus	62.50
Do	...do	Lot tinder boxes, bags, etc	M. Ash	7.00
Do	...do	Lot curtains and carpets	J. Dreifus	28.00
Do	...do	2 devils claws	Purvis & Son	.84
Do	...do	307 pounds castings	M. H. Gregory	38.37
Do	...do	Horse-shoe nails	Purvis & Son	.84
Do	...do	Lot cots, hammocks, etc	H. Bernheimer	35.00
Do	...do	6 looking-glasses, etc	F. Gross	6.00
Do	...do	245 windsail hoops, etc	J. J. Johnson	1.00
Do	...do	5 grapnels	D. Donovan	6.25
Do	...do	Lot canvas, hose, etc	S. Bensinger	46.00
Do	...do	Hooks and thimbles	J. J. Johnson	4.74
Do	...do	Cooking utensils	F. Ernstein	7.00
Do	...do	Life-preservers	...do	10.00
Do	...do	Cooking utensils	M. Sugenheimer	4.00

Statement of sales of condemned materials, etc.—Continued.

Date of sale.	Where sold.	Materials sold.	Purchasers.	Amount realized.
1888.				
Mar. 6	Washington	Neatsfoot oil	S. Bensinger	$46.32
Do	do	Handy-billy engine	Purvis & Son	37.50
Do	do	Wafers, seals, etc	M. Ash	.25
Do	do	Lot thimbles, etc	Nolan Bros	2.75
Do	do	Lot brushes, etc	T. Collins	1.10
Do	do	Fire extinguishers, charges for	J. Dreifus	.72
Do	do	3,912 pounds hemp rope	M. Ash	185.82
Do	do	3,347 pounds hemp rope	do	209.12
Do	do	790 pounds hemp rope	do	49.94
Do	do	2,557 pounds hemp rope	do	156.81
Do	do	3,311 pounds hemp rope	do	206.94
Do	do	580 pounds manila rope	J. Dreifus	31.90
Do	do	Fire extinguishers, etc	S. A. Cormey	46.35
Do	do	770 pounds old files	E. G. Wheeler	11.55
Do	do	Parts of galley	J. Dreifus	14.00
Do	do	Felt, deck stoppers, etc	Nolan Bros	30.00
Do	do	Cast-iron forges, parts of	J. Dreifus	81.42
Do	do	90 pounds copper pipe	Purvis & Son	11.70
Do	do	Miscellaneous lot	M. Burke	8.92
Do	do	8,005 pounds junk	M. Ash	120.07
Do	do	4 barrels tar	J. Dreifus	2.50
Do	do	1,735 pounds bolt rope	M. Ash	91.09
Do	do	2,110 pounds bolt rope	do	105.50
Do	do	1,595 pounds bolt rope	do	99.69
Do	do	Miscellaneous lot	M. Burke	3.95
Do	do	Old copper wire	M. H. Gregory	27.04
Do	do	Lot shakings	M. Ash	55.55
Do	do	Miscellaneous lot	M. Hoffmeyer	.03
Do	do	Grate bars	J. Dreifus	6.81
Do	do	Condemned chain (583,895 pounds)	Driscoll	3,649.34
Do	do	Condemned chain (186,150 pounds)	Wilson & Co	1,163.93
Do	do	Scrap-iron (30,010 pounds)	Driscoll	187.56
Do	do	Brass tubes (12,780 pounds)	Butler	910.57
Do	do	4 old galleys	Driscoll	25.13
Do	do	13,532 pounds shakings	M. Burke	223.26
	Total			8,066.47
1887.				
Sept. 20	Mare Island	Galvanized filters	E. Supple	1.30
Do	do	Shoemaker's tools	do	1.10
Do	do	Bulkhead curtains	do	1.25
Do	do	do	do	.50
Do	do	Lot table covers	do	1.25
Do	do	Lot rugs	do	1.70
Do	do	2 anchor buoys	W. G. Mighell	7.00
Do	do	1 kedge buoy	W. M. Mighell	3.50
Do	do	15,900 pounds junk	W. G. Mighell	184.44
Do	do	15 chain relievers	L. Ford	12.50
Do	do	29 devil's claws	do	24.50
Do	do	170 fairleaders	do	1.00
Do	do	11 hook wrenches	do	1.38
Do	do	21 ladder rungs	do	.50
Do	do	Anchor (4,830 pounds)	C. Budrow	78.48
Do	do	Anchor (4,190 pounds)	do	68.09
Do	do	Anchor (4,168 pounds)	do	67.73
Do	do	Anchor (3,750 pounds)	do	44.68
Do	do	Anchor (3,450 pounds)	do	56.06
Do	do	Anchor (3,075 pounds)	do	49.97
Do	do	29,049 pounds junk	do	798.84
Do	do	18,671 pounds junk	do	392.09
Do	do	2 anchor stocks	A. Powell	2.00
Do	do	Life-preservers	T. P. H. Whitelow	5.00
Do	do	Mooring swivels	C. Harlow	39.37
Do	do	Lot wire rope	do	22.00
Do	do	49,255 pounds junk	do	861.96
Do	do	Lot shakings	Davis & Ford	7.50
	Total			2,735.50
1888.				
May 8	Pensacola	1 anchor (654 pounds)	L. Kaufman	3.35
Do	do	1 anchor (635 pounds)	do	3.25
Do	do	1 anchor (477 pounds)	J. Hallet	4.50
Do	do	1 anchor (450 pounds)	do	4.50
Do	do	1 anchor (430 pounds)	do	4.50
Do	do	1 anchor (400 pounds)	do	4.50
Do	do	1 anchor (385 pounds)	do	4.50
Do	do	1 anchor (380 pounds)	do	4.50

Statement of sales of condemned materials, etc.—Continued.

Date of sale.	Where sold.	Materials sold.	Purchasers.	Amount realized.
1888.				
May 8	Pensacola	1 anchor (635 pounds)	F. Bannerman	$4.00
Do	...do	1 anchor (632 pounds)	...do	4.00
Do	...do	1 anchor (630 pounds)	...do	4.00
Do	...do	1 anchor (610 pounds)	...do	4.00
Do	...do	1 anchor (600 pounds)	...do	4.00
Do	...do	1 anchor (505 pounds)	...do	4.00
Do	...do	1 anchor (350 pounds)	...do	4.00
Do	...do	1 anchor (335 pounds)	...do	4.00
Do	...do	1 anchor (313 pounds)	...do	4.00
Do	...do	1 anchor (310 pounds)	...do	4.00
Do	...do	1 anchor (287 pounds)	...do	4.00
Do	...do	1 anchor (275 pounds)	...do	4.00
Do	...do	1 anchor (220 pounds)	...do	4.00
Do	...do	1 anchor (125 pounds)	...do	4.00
Do	...do	1,094 pounds rope (5½-inch)	W. H. Hutchinson	34.19
Do	...do	2,628 pounds rope (5-inch)	J. Hallet	75.55
Do	...do	2,945 pounds rope (4½-inch)	W. H. H. Cory	92.03
Do	...do	1,885 pounds rope (4-inch)	L. K. Hirsch	58.91
Do	...do	1,517 pounds rope (3½-inch)	H. Horsler	47.41
Do	...do	1,282 pounds rope (2½-inch)	Captain Nord	48.07
Do	...do	1 anchor (3,750 pounds)	W. H. H. Cory	12.25
Do	...do	1 anchor (2,800 pounds)	M. Schwartz	9.75
Do	...do	1 anchor (1,827 pounds)	J. Barry	17.00
Do	...do	1 anchor (1,620 pounds)	...do	13.00
Do	...do	1 anchor (1,600 pounds)	L. K. Hirsch	17.50
Do	...do	1 anchor (1,520 pounds)	...do	14.00
Do	...do	1 anchor (1,510 pounds)	J. Barry	10.00
Do	...do	1 anchor (1,220 pounds)	L. K. Hirsch	9.75
Do	...do	1 anchor (1,200 pounds)	L. Boly	12.25
Do	...do	1 anchor (1,180 pounds)	L. K. Hirsch	6.75
Do	...do	1 anchor (1,112 pounds)	M. Burke	7.75
Do	...do	1 anchor (1,095 pounds)	...do	11.25
Do	...do	1 anchor (1,000 pounds)	...do	10.25
Do	...do	1 anchor (990 pounds)	...do	7.75
Do	...do	1 anchor (970 pounds)	J. Barry	8.25
Do	...do	1 anchor (956 pounds)	M. Schwartz	8.50
Do	...do	1 anchor (820 pounds)	L. Boly	9.00
Do	...do	1 anchor (755 pounds)	...do	9.00
Do	...do	1 anchor (750 pounds)	...do	9.00
Do	...do	1 anchor (745 pounds)	...do	9.00
Do	...do	1 anchor (740 pounds)	...do	9.00
Do	...do	1 anchor (740 pounds)	M. H. Heilp	6.00
Do	...do	1 anchor (720 pounds)	...do	6.00
Do	...do	1 anchor (715 pounds)	...do	6.00
Do	...do	1 anchor (700 pounds)	...do	6.00
Do	...do	1 anchor (696 pounds)	...do	6.00
Do	...do	1 anchor (660 pounds)	L. Kaufman	3.25
Do	...do	1 anchor (660 pounds)	...do	3.25
Do	...do	1 anchor (655 pounds)	...do	3.25
Do	...do	461 pounds rope (1½-inch)	Captain Nord	18.44
Do	...do	1,410 pounds rope (7-inch)	M. Burke	44.06
Do	...do	2,784 pounds rope (8½-inch)	J. Hallet	87.00
Do	...do	4,086 pounds rope (7½-inch)	W. H. Hutchinson	127.68
Do	...do	3,748 pounds rope (10-inch)	W. H. H. Cory	117.13
Do	...do	2,831 pounds rope (9-inch)	M. Burke	88.47
Do	...do	2,400 pounds rope (8-inch)	W. H. H. Cory	66.00
Do	...do	1,806 pounds rope (7-inch)	M. Burke	56.44
Do	...do	1,554 pounds rope (6½-inch)	...do	48.57
Do	...do	4,221 pounds rope (5-inch) manilla	W. H. H. Cory	126.63
Do	...do	1,821 pounds rope (4½-inch) manilla	M. Burke	75.12
Do	...do	11,220 pounds junk	J. Hallet	140.25
Do	...do	2,765 feet manilla fall	M. Burke	6.91
Do	...do	18 dish covers, tin	A. E. Hamilton	
Do	...do	2 dish covers, wire	...do	5.25
Do	...do	83 flints	...do	
Do	...do	1,887 thimbles, iron	M. Burke	
Do	...do	108 jewsharps	...do	25.50
		Total		1,734.86
1888.				
January 18	League Island	11 scrapers	J. Dreyfus	
Do	...do	1 iron kettle	...do	1.00
Do	...do	13 tinder boxes	...do	
Do	...do	candlesticks	...do	
Do	...do	2,025 pounds canvas	M. Burke	202.50
Do	...do	6,465 pounds sheer fall	M. J. Ash	169.71
Do	...do	7,083 pounds wire rope	M. Burke	115.10

Statement of sales of condemned materials, etc.—Continued.

Date of sale.	Where sold.	Materials sold.	Purchasers.	Amount realized.
1888.				
January 18	League Island	16 blocks	M. Burke	$1.10
Do	do	6 hawsers	M. J. Ash	669.87
Do	do	1 towline	do	
Do	do	Chains, spans, guys	J. Dreyfus	5.50
Do	do	3 seines	do	38.00
Do	do	2,005 pounds chain	Nolan Brothers	35.09
Do	do	2,735 pounds old rope	J. McCusker	102.56
Do	do	705 pounds clew irons	F. Bannerman	8.53
Do	do	5 hemp messengers	M. Burke	164.19
Do	do	1 hemp hawser	do	
Do	do	2 manila hawsers	S. A. Comey	38.49
Do	do	Composition chain	Hamill	109.80
Do	do	670 feet rubber hose	J. McHugh	9.00
Do	do	7 rigging screws	M. Burke	.56
Do	do	Left-handed rope	M. J. Ash	66.75
Do	do	Manila shakings	M. Burke	2.09
Do	do	23 coils spun yarn	F. Bannerman	78.92
Do	do	22 coils ratline	M. Burke	73.13
Do	do	1 manila hawser	S. A. Comey	17.33
Do	do	Bolt rope	E. J. Fitzgerald	176.94
Do	do	Manila hawsers	M. Burke	2.60
Do	do	Lot old rope	do	3.00
Do	do	27 boat stoves	S. A. Comey	83.75
Do	do	10 coils spun yarn	Fitzgerald	78.32
Do	do	2 table covers, etc	T. W. Cook	2.50
Do	do	Fire extinguishers	Henry	9.00
Do	do	2 water coolers	J. Dreyfus	1.00
Do	do	3 life suits	George Williams	2.63
Do	do	Chain cable (117,797 pounds)	M. Burke	1,177.97
Do	do	7 blocks	Hallet	1.50
Do	do	4,265 pounds hawsers	F. Bannerman	101.29
Do	do	5 manilla hawsers	M. J. Ash	339.72
Do	do	2 manilla hawsers	F. Bannerman	166.04
Do	do	7 manilla hawsers	M. Burke	652.00
Do	do	do	S. A. Comey	670.00
Do	do	5,910 pounds hawsers	M. J. Ash	221.63
Do	do	Lot hemp rope	W. Fitzgerald	7.19
Do	do	1 galley	Purvis & Son	67.50
		Total		5,618.80
1887.				
August 30	New York	Anchors and jewsharps	E. Driscoll	173.10
Do	do	Awl-handles	S. G. Windernitz	1.00
Do	do	Tinder boxes, etc	S. Hurley	4.00
Do	do	Lot hammocks and bags	Mr. McMahon	175.00
Do	do	Coir brushes, etc	do	15.00
Do	do	Anti-Lathel powder	E. Driscoll	10.00
Do	do	Lamp chimneys, etc	Mr. Stern	1.00
Do	do	Scrap brass, etc	E. Driscoll	36.84
Do	do	Chain surges	Mr. Cook	9.00
Do	do	Lot canvas	Daniel Kane	665.00
Do	do	Fids, scrapers, etc	Peter Young	12.00
Do	do	Fire extinguishers, etc	do	80.00
Do	do	22,000 pounds cast iron	E. Driscoll	137.50
Do	do	180,590 pounds scrap iron	do	1,128.68
Do	do	112,670 pounds scrap iron	Mr. Gibson	704.18
Do	do	Hooks and thimbles, hand and leg irons.	Mr. Abbey	83.07
Do	do	Leading-hose, etc	E. Driscoll	175.00
Do	do	Cork jackets	do	12.00
Do	do	Mallets, etc	do	5.00
Do	do	Neat's-foot oil and varnish	do	110.00
Do	do	Handy billy pumps	Peter Young	135.00
Do	do	Lot stationery	E. Driscoll	15.00
Do	do	Cooking utensils	do	60.00
Do	do	36 stoves	Mr. Buckley	5.00
Do	do	960 pounds shackles	E. Driscoll	7.20
Do	do	Brass square, wire splicers, etc	S. G. Winternitz	9.00
Do	do	Lot basins, tubs, etc	Mr. Stein	20.00
Do	do	Hemp hawsers	Mr. Gibson	225.28
Do	do	Manilla hawsers	do	4,430.47
Do	do	Hemp rigging	do	2,947.61
Do	do	do	do	1,272.76
Do	do	Manilla rigging	do	1,856.45
Do	do	Manilla towlines	Daniel Kane	119.82
Do	do	Wire rigging	E. Driscoll	165.81

Statement of sale of condemned materials, etc.—Continued.

Date of sale.	Where sold.	Materials sold.	Purchasers.	Amount realized.
1887.				
August 30	New York	Chain cable	E. Driscoll	$1,957.10
Do	...do	Table furniture	Samuel Hurley	21.06
Do	...do	Spittoons, etc	...do	6.00
Do	...do	Lot curtains and table covers	Mr. McMahon	29.00
Do	...do	Mattresses, pillows, etc	Thomas Allen	28.00
Do	...do	2,560 pounds clippings	Daniel Kane	102.40
Do	...do	Dish covers	J. G. Warner & Co.	25.00
Do	...do	Table furniture	Mr. Stern	31.00
Do	...do	Lot glassware	Mr. Fulton	5.75
Do	...do	10,670 pounds shakings	Daniel Kane	213.40
Do	...do	Rope jacks and rope-laying machines.	Peter Young	22.00
		Total		17,247.38
Nov. 22, 23	Boston	Cushion covers	L. E. Lunt	
Do	...do	Mirror frames	...do	
Do	...do	Curtains	...do	
Do	...do	Dish covers	...do	5.25
Do	...do	Shoe knives	...do	
Do	...do	Sail knife	...do	
Do	...do	Measuring line	...do	
Do	...do	Hose, rubber	E. L. Fitzgerald	19.87
Do	...do	Hose, canvas	...do	
Do	...do	Bake-ovens	L. E. Lunt	12.72
Do	...do	Life-preservers	S. McKenna	22.40
Do	...do	Seine	Thomas Fowle	11.00
Do	...do	Shovels and pokers	L. E. Lunt	20.00
Do	...do	Chain-slings	S. A. Comey	44.98
Do	...do	Thimbles	...do	76.74
Do	...do	Anchor	A. J. McShane	86.90
Do	...do	...do	...do	92.20
Do	...do	Hemp shakings	Nolan Bros	21.25
Do	...do	Wire rope	L. E. Lunt	290.23
Do	...do	Manilla hawser	T. W. Brophy	211.50
Do	...do	...do	Nolan Bros	78.99
Do	...do	...do	T. W. Brophy	27.00
Do	...do	...do	...do	42.21
Do	...do	Hemp rope	Jos. Hancock	774.50
Do	...do	Hemp hawser	S. A. Comey	142.55
Do	...do	...do	W. Lynch	31.85
Do	...do	Hemp rope, left-hand	J. Robertson	15.67
Do	...do	...do	W. Lynch	7.29
Do	...do	Hemp rope	J. Robertson	37.83
Do	...do	...do	M. J. Ash	173.00
Cash deposited on account of lots sold, but not removed; forfeited by terms of sale				99.84
				2,345.77

Statement of expenses attending sales at public auction.

Sale of October 11 and 12, 1887, at Portsmouth, N. H.:	
Auctioneer's fees	$197.40
Sale of March 6, 1888, at Washington, D. C.:	
Auctioneer's fees	147.69
Advertising	38.70
Printing	6.04
	192.43
Sale of September 20, 1887, at Mare Island, Cal.:	
Auctioneer's fees	68.35
Sale of May 8, 1888, at Pensacola, Fla.:	
Auctioneer's fees and other expenses	129.80
Sale of August 30, 1887, at New York:	
Auctioneer's fees and other expenses	705.67
Sale of September 22 and 23, 1887, at Boston, Mass.:	
Labor	36.52
Advertising and printing	8.14
Auctioneer's fees	35.19
	79.85

Recapitulation.

Total sales	$50,909.09
Total expenses	1,373.62
Amount turned into Treasury	49,535.47

No. 6.—BUREAU OF NAVIGATION.

BUREAU OF NAVIGATION, NAVY DEPARTMENT,
Washington, October 25, 1888.

SIR: I have the honor to submit the annual report of the operations of the Bureau of Navigation for the past year, together with the estimates for its support, and that of the offices under it, and for the expenditures which will, in my opinion, be necessary for the naval service during the fiscal year ending June 30, 1890.

Included in this report, and transmitted herewith, are the reports of the Superintendent of Compasses; the Naval Inspector of Electric Lighting; the Naval War College; the Hydrographic Office; the Naval Observatory, and the Nautical Almanac Office.

Nautical instruments.—Forty chronometers of domestic manufacture have been given a six months' competitive trial at the Naval Observatory during the past year. Fourteen of these instruments have been purchased for the naval service. The chronometers now obtained are much superior to those purchased in former years, a result due directly to the careful tests, at varying temperatures, now made previous to purchase. Chronometers of foreign make are no longer purchased for the Navy.

Sextants and glasses are now examined at the Naval Observatory before purchase or issue. A standard spy-glass has been approved, to which all future purchases will be required to conform. A similar step is in contemplation with regard to binocular glasses, and when this is consummated the service will thereafter be in possession of glasses greatly superior to those heretofore in use.

Ten old 7½-inch and thirty boat compasses have been altered during the past year to conform to the standard patterns. For want of sufficient funds the repairs of a considerable number of compasses have been deferred.

Ten compensating binnacles of an improved kind, intended for the new cruisers, are in course of construction.

I beg to refer to the appended report of the Superintendent of Compasses for the details of the preliminary observations for establishing the magnetic conditions of the new vessels.

Ships' libraries.—Additional professional books have been added to the libraries of cruising ships, which now comprise more than five hundred volumes. These library books are intended for the use of all officers and enlisted men attached to cruising vessels, and are much appreciated during the long and tedious cruises abroad.

Electric lighting.—I beg to call your attention to the report of Lieutenant Commander R. B. Bradford, the naval inspector of electric lighting, which sets forth in detail the operations of the Bureau during the past year in the matter of introducing electric lights into naval ships.

I ask for your favorable consideration of this important subject. The first man-of-war in the world to be lighted by electricity, the *Trenton*, was installed under the direction of this Bureau, under an approropriation especially asked for by the Bureau for that purpose. From the first this method of lighting has been successful, and it is now conceded that no ship is complete without electric lights; they have been proved beyond a doubt to exert a direct and salutary influence upon the sanitary condition, the discipline, and the efficiency of vessels of war.

By placing the entire subject of electric lighting in the hands of one expert inspector, great progress has been made in perfecting the special appliances required for installing ships. The new ships now being lighted will have very superior installations.

Previous to this year estimates for lighting ships of war have been included with other supplies in a lump sum. This has been continued for the next fiscal year in order that there may be an appropriation available for unforeseen necessities in the way of supplying material and for maintenance. In addition estimates are submitted for purchasing plants for specific ships which are not otherwise provided for. Estimates for increasing the size of the plants of the *Baltimore* and *Charleston* are also submitted, as the plants being put in by the contractors are too small to supply the increased demands for electricity in these ships.

Ocean surveys.—The surveying work of the *Ranger* in the Pacific has continued in a satisfactory manner. For the benefit of vessels trading between San Francisco and the ports of Mexico and Central America, the coast of Lower California is being carefully examined and the charts resulting are issued by the Hydrographic Office in a rapid and creditable manner.

In addition to the strictly hydrographic work of this vessel, excellent magnetic and topographic work has been done by the shore parties.

Valuable surveys have also been made by the *Mohican* in Samoa and by the *Vandalia* at the Sandwich Islands.

The *Palos* and *Essex* in Corea, and the *Yantic* and *Enterprise* in the Atlantic deserve special mention for useful hydrographic surveys and deep-sea soundings.

The Pacific is dotted all over with shoals and islands concerning which very little is known; while the charts of some parts of the West Indies and the Spanish Main, frequented by American commerce, are known to be far from correct.

The Hydrographer has called attention particularly to the necessity for an examination of the bar at the mouth of the Orinoco. The inconvenience of detailing a ship of war for continuous surveying operations requiring special outfits and the increasing demands of commerce for charts of little-known localities, make it advisable for the Department to have at least two properly-found steamers in the Atlantic and Pacific for this kind of work.

Derelicts.—I again strongly recommend that a small vessel be assigned to the duty of destroying or removing from the track of vessels approaching our great Atlantic sea-ports, the many wrecks and portions of wrecks now so dangerous to coasting and foreign vessels.

This can be done at small expense, as no special fittings are required.

Requests for the removal or destruction of wrecks are constantly received from maritime and other associations, which frequently can not be complied with because of the want of a vessel for such work.

Longitude measurements and magnetic observations.—Lieut. J. A. Norris, with a party, will leave the United States in November for the pur-

pose of determining the longitude by telegraphic signals and making magnetic observations at the following-named points: Vera Cruz, Mexico; Coatzacoalcos, Mexico; Salina Cruz, Mexico; La Libertad, Salvador, and San Juan del Sur, Nicaragua.

Telegraph lines now extend from Vera Cruz, by cable, to Coatzacoalcos, thence, by land, across the Isthmus of Tehuantepec to Salina Cruz, on the Pacific coast. From Salina Cruz a cable extends to the south, touching at La Libertad, San Juan del Sur, Panama, and several points on the South American coast.

The differences of longitude to be measured by telegraph are between the various ports mentioned, from Vera Cruz to San Juan del Sur. The longitude of Vera Cruz was established in the spring of 1883, and that of Libertad from Panama in 1884. The expedition proposed for this winter will connect these points, thus making an unbroken series of telegraphic measurements, extending from Washington to Cordova, in the Argentine Republic, and will also put in the measurement from Libertad to San Juan del Sur, near the Pacific terminus of the proposed Nicaragua canal. The importance and amount of this work will render it advisable to keep this thoroughly-equipped party in the field for a considerable time to come.

Hydrographic Office.—The report of the Hydrographer shows in detail the operations of this important office. The branch offices in our sea-board cities continue to be of great value to maritime communities, and also to the Department, and should be liberally supported.

Attention has been previously called to the fact that the present quarters of the Hydrographic Office are entirely inadequate. Greater economy in time and labor would follow, and better results could be accomplished if the Hydrographic Office were placed in a building specially constructed for it. As the supply of valuable engraved copper-plates is rapidly increasing beyond the capacity of the room for storage, and as the printing of the charts can not be carried on in a building devoted to offices, unless specially built, a plain fire-proof building should be constructed, giving plenty of light for the engravers and draughtsmen, and so arranged as to render all parts of it easily and quickly accessible. I would suggest, therefore, that an appropriation be recommended for the construction of a specially adapted building, and that in the mean time an increased appropriation be obtained for the renting of buildings of sufficient capacity.

Nautical Almanac Office.—The report of the Superintendent shows the work performed during the past year. The American Nautical Almanac for 1891 was issued from the press in April last, and of the volume for 1892, 325 pages are in type. The computations for the volumes of 1893 and 1894 are in a state of forwardness.

The preparation of new tables of the planets is also progressing favorably.

Naval Observatory.—The report of the Superintendent of the Naval Observatory details the work performed with the great equatorial, transit circle, and other instruments, which have been in constant use when the weather permitted. Attention is called to the backward state of the work of the transit circle, owing to the want of a sufficient force of computers, and two additional computers are asked for; this request meets with the approval of the Bureau.

The chronometer and time service department has been increased in efficiency in various ways.

The daily time signal at noon of the seventy-fifth meridian has been sent over the wires of the Western Union Telegraph Company, and

time-balls have been dropped at various points on the coast. In the estimates for the support of the Observatory an appropriation of $5 is asked for to maintain this service properly and to extend its bei ts to other commercial cities. This estimate meets with the hearty approval of the Bureau, and the special attention of the Department is asked to this important item.

The Gardner system continues successfully to supply the various public buildings in this city with the standard time from the Observatory, and has been definitely adopted by the Patent Office to the exclusion of all others.

The work of the magnetic observatory has been pursued during the year, and the results will be ready for publication at an early date.

The report of Lieut. A. G. Winterhalter on the International Astro-photographic Congress is now in press, and will shortly be followed by that on the various observatories visited by him while in Europe under the orders of the Department.

Attention is especially called to the proposed charting of the heavens by the photographic process and the necessity for an adequate appropriation to enable the Observatory to perform its share of this great work.

Work upon the new Observatory on Georgetown Heights has begun. It will be necessary in order to the uninterrupted progress of the work that the appropriation for the next fiscal year be made immediately available, and the whole amount asked for should be granted, as it will be required during the fiscal year 1890.

Department library—The Department library has received the usual accessions during the past year. The preparation of the catalogue l been nearly completed, and will be printed this year, if possible. The selection of works for the library has been rigidly confined to the needs of the Department, and no books are purchased save those of a professional or technical character, or such as are required for reference the various branches of naval investigation. The indispensable and constantly increasing material for study in the various professional journals imposes upon the library the necessity of devoting a considerable sum to these acquisitions. This fact, and the heavy cost of certain technical but absolutely necessary publications, make it desirable to increase the appropriation from the amount allotted last year, namely, $1,000, to $2,500, as provided prior to the fiscal year 1885–'86. The reduced amount does not meet the actual necessities of the Department.

Naval War Records.—The preparation of the Naval War Records for publication, first directed by Congress in the act of July 7, 1884, has hitherto made slow progress, owing to the smallness of the clerical force authorized for the work. By the act of July 11, 1888, the force was for the first time placed on such a footing as to enable the office to make a substantial beginning. In order to carry it on to completion within a reasonable time it is absolutely essential that the number of clerks and copyists should be now increased, and estimates have been submitted with this object.

The importance and value of these records have been frequently alluded to in my reports, but I now call attention to the subject, as Congress, by its action last year, has shown its intention that the work should be seriously prosecuted. There is no doubt whatever that the Army War Records, for the compilation of which a liberal provision has been made, form to-day one of the most valuable and most sought-after of all the Government publications. The naval records are of equal importance, and demand equal attention. Without them the record is

incomplete. In some respects they are even more important than those of the Army. The civil war is not only the first war in which naval operations on a great scale have been conducted since the introduction of steam, but it is the only war in which those modern appliances have been used which have revolutionized the art of naval warfare. The only operations of any magnitude with rams, with torpedoes, with iron-clads, with rifled ordnance, and it might be added with steam-vessels, that can be studied by the professional man are those of the war of 1861–'65. The maintenance of a steam blockade and the employment of commerce-destroying steam-cruisers, two of the most important operations of modern war, occurred only in this conflict. To place this record in a permanent and accessible form, where it can be referred to by the naval service, by the executive and legislative departments of the Government in their efforts to insure the highest efficiency in the Navy, and by the public generally, is the object of this publication, which clearly ought to appear side by side with that of the War Department.

The necessity of speedy action in providing for the work is apparent, by reason of the fact that a large quantity of official correspondence at the close of the war, as is well known, remained in private hands, and is thus in danger of loss or destruction. Each year's delay makes it more difficult to obtain these papers, and the office with its present limited force is unable to handle them. It is therefore desirable that no time should be lost in putting the force upon its proper footing.

The estimates submitted for an increase include three clerks of class 4, one of them to be employed in indexing the work and another in the preparation of statistical tables. The third will be employed in the general work of verification and classification. The absolute accuracy required in these matters, without which the publication will be valueless, calls for a high standard of ability, which experience has shown can not be obtained in the lower grades of the clerical force. The remaining clerks asked for are required for the examination of bureau and fleet records, of navy-yard records, and of official papers obtained from officers and their representatives. Four additional copyists are asked for at $900 each. These are urgently needed for the actual work of copying records, it being found that the best qualified copyists presented by the civil service will not, as a rule, accept the lower rate, since other branches of the service offer them better compensation, although there is no branch where greater accuracy is required. An assistant messenger is also urgently needed, and an estimate has been submitted therefor.

For the stationery and other contingent expenses of the office of Naval War Records a moderate estimate of $500 has been submitted. This is obviously necessary, as there is no provision at present made by law for this purpose.

It is earnestly hoped that Congress, having made a good beginning of this very important work, may now be induced to push it to speedy completion.

Naval War College.—The fourth annual session of the Naval War College opened on the 6th of August. The programme as reported by Capt. A. T. Mahan, U. S. Navy, the president of the college, shows a continued improvement and extension in the course of study. Instruction was given, as in previous years, by lectures and by oral discussion. The more important courses included lectures on naval history, involving the consideration of naval power as a strategic factor of war, and the tactical employment of naval forces, by the president of the college; on naval strategy and fleet battle tactics and the strategic features of

the Gulf Coast, also by Captain Mahan; on sea-coast defense, by General H. L. Abbot, Corps of Engineers, U. S. Army, and on military strategy, by First Lieut. J. P. Wisser, First U. S. Artillery; on the naval conditions of the war of 1812, by Theodore Roosevelt, esq.; on the tactics of the ram, by Commander P. F. Harrington, U. S. Navy; those of the by Lieut. J. F. Meigs, and of the torpedo, by Lieut. D. Kennedy; on commercial sea-routes and the strategic features of the Pacific coast of the United States, by Lieut. Commander C. H. Stockton; on the naval war game, by Lieut. McCarty Little; on naval gunnery, by Lieut. J. F. Meigs; on naval reserves, by Lieut. S. A. Staunton; on the strategic study of lake frontier of the United States, naval logistics, and the duties of the general staff, by Lieut. C. C. Rogers; on the preservation and care of iron ships, by Naval Constructor R. Gatewood; on naval hygiene, by Medical Director R. C. Dean; and on international law, by Prof. J. R. Soley.

The above programme shows that the course at the Naval War College has been strictly confined to the purposes for which the institution was intended, and is at the same time comprehensive and searching within its proper scope. The subjects treated are of the first importance to the naval profession. The recent tendency of intellectual activity in the service has been rather towards subjects connected with the development of material. While no one should underrate the importance high training for officers in this direction, it must be admitted that material development would be useless without a corresponding training in the art of conducting naval war. It is to this object that the Naval War College is devoted, and it is believed that it has hitherto fulfilled the object of its creation as far as the limited means at its c mand would permit. The subjects which its instructors have been called upon to discuss are of modern growth, and have received little systematic treatment in published works, especially in the United States. Text-books as such have, therefore, been of little assistance, and it was necessary that the branches of naval science to be taught should be largely developed by the instructors themselves. Much credit must be accorded to the officers who have voluntarily and, for the most part, in addition to other duties, given their time and labor to the preparation of lectures for the college. Their efforts have not been without important fruit, for the institution, whose novel plan and method in the beginning awakened sharp professional criticism, has steadily grown in favor, and now counts among its ardent supporters not only all the officers who have followed its courses, but also, it is believed, the great majority of the service generally, which recognizes in the college the instrument for supplying a long felt want. There is no doubt whatever that it has already directed the attention of a large number of officers to the consideration of the new problems of naval warfare, and has stimulated active thought and research in reference to these problems throughout the whole service. It is the earnest recommendation of the Bureau that whatever changes may be made in the administrative relations of the War College, nothing may be done to interrupt the attainment of its main object, namely, the systematic study by naval officers of the practice and methods of modern war as applied to the special necessities of the United States.

The Bureau would desire to call particular attention to the very valuable services rendered by First Lieut. T. H. Bliss, First U. S. Artillery, in his lectures on military strategy, during the three years of his connection with the college, and to express, at the close of his term of service, its sense of the fidelity and ability with which his duties have been performed.

Naval reserves.—I beg to again invite your favorable attention to the subject of establishing a system of naval reserves to meet the demands of the country for rapidly manning and increasing its fleet upon the outbreak of war, as indicated in your last annual report.

At present no means exist for providing the fleet with a single trained man beyond the number prescribed by law for the peace establishment, and it would seem that no argument should be necessary to secure the required legislative authority.

The study and energy of maritime nations is being devoted to placing their reserves of men, as well as material, in such a state of training and readiness as to make them available for effective service on twenty-four hours' notice.

Rapid mobilization may be said to be the leading naval question of the day, and the recent naval maneuvers abroad have given occasion for the frequent statement of the opinion that to readiness of ships and guns must be joined an equal readiness of trained men to make any system of mobilization complete and effective.

By your direction information concerning the systems of reserves in other countries has been compiled and forwarded to Congress, and upon it and the requirements of our needs and institutions the Whitthorne bill has been framed and favorably reported to the House of Representatives.

The passage of such an act would convey ample authority and means to create a most valuable addition to our naval strength.

International marine conference to secure greater safety for life and property at sea.—Attention has been frequently called in the annual reports of this Bureau to the expediency of adopting measures to reconcile the differences existing in the regulations of various maritime states for the prevention of collisions at sea; to bring about the establishment of a universal system of marks and buoys for channels and approaches to harbors; to provide for the removal of derelicts, and in general to contribute to the security of navigation at sea, to promote which has always been one of the chief endeavors of the Bureau. The Bureau has also suggested, in reference to certain of these measures, the advantages of referring them to an international congress to obtain a uniform and authoritative conclusion. In accordance with these recommendations, Congress at its late session passed the act (approved July 9, 1888) providing for an international marine conference to secure greater safety for life and property at sea, as follows:

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the President of the United States be, and he hereby is, authorized and requested to invite the government of each maritime nation to send delegates to a marine conference that shall assemble at such time and place as he may designate, and to appoint seven delegates, two of whom shall be officers of the United States Navy, and one an official of the Life-Saving Service, two masters from the merchant marine (one from the sailing marine and one from the steam marine), and two citizens familiar with shipping and admiralty practice, to represent the United States at said marine conference, and to fill vacancies in their number.

SEC. 2. That it shall be the object of said marine conference to revise and amend the rules, regulations, and practice concerning vessels at sea, and navigation generally and the "International Code of Flag and Night Signals;" to adopt a uniform system of marine signals, or other means of plainly indicating the direction in which vessels are moving in fog, mist, falling snow, and thick weather, and at night; to compare and discuss the various systems employed for the saving of life and property from shipwreck, for reporting, marking, and removing dangerous wrecks or obstructions to navigation, for designating vessels, for conveying to mariners and persons interested in shipping warnings of approaching storms, of dangers to navigation, of changes in lights, buoys, and other day and night marks, and other important information; and to formulate and submit for ratification to the governments of all mari-

time nations proper international regulations for the prevention of collisions and other avoidable marine disasters.

SEC. 3. That the sum of twenty thousand dollars, or so much thereof as shall be necessary, is hereby appropriated, out of any money in the Treasury of the United States not otherwise appropriated, for the necessary expenses of said marine conference, including the pay and allowances of the representatives of the United States therein, which shall be at the rate of five thousand dollars per annum, and actual necessary expenses, for such delegates as are not salaried officers of the United States, and the latter shall be allowed their actual necessary expenses. The Secretary of the Navy is hereby authorized to provide the conference with such facilities as may be deemed necessary. The powers and authority conferred by this act upon the persons appointed by the President by force thereof shall terminate on the first day of January, anno Domini eighteen hundred and ninety, or sooner at the discretion of the President.

SEC. 4. That it shall be the duty of the Secretary of State to transmit to Congress a detailed statement of the expenditures which may have been incurred under the provisions of this act.

The importance of the conference, for the calling of which Congress has thus given authority and made provision, can not be overestimated, and suggests the expediency of early action with a view to preparing thoroughly for the proposed deliberations.

Their scope is comprehensive, including the whole system of regulations and practice concerning vessels at sea, and navigation generally; international marine signals; the saving of life and property from shipwreck; the reporting and removal of wrecks; the system of designating vessels; storm warnings and notices of dangers to navigation; and the prevention of collisions. Never before has so far-reaching an investigation or discussion of the subject been undertaken by maritime states, and it may safely be predicted that the successful completion of the labors of the conference will mark a distinct epoch in the progress of ocean navigation. It is a matter of national satisfaction that it has fallen to the United States to take the initial steps, which, it may be confidently hoped, will lead to a codification of the rules of navigation, and thereby promote immeasurably the safety of ships at sea.

Very respectfully, your obedient servant,

J. G. WALKER,
Chief of Bureau.

The SECRETARY OF THE NAVY.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1890, by the Bureau of Navigation.

FOR THE SUPPORT OF THE BUREAU OF NAVIGATION.

A.

SALARIES.

Chief clerk (July 11, 1888)	$1,800
One clerk of class three (same act)	1,600
One clerk of class two (same act)	1,400
One clerk of class one (same act)	1,200
One copyist (same act)	900
One assistant messenger (same act)	720
Three laborers, at $660 each (same act)	1,980
	9,600
One clerk class one (submitted)	1,200
	10,800

B.

SALARIES, OFFICE NAVAL INTELLIGENCE.

One stenographer (July 11, 1888)	$1,600
One laborer (submitted)	660
	2,260

C.

SALARIES, OFFICE OF NAVAL RECORDS OF THE REBELLION.

Two clerks of class one (July 11, 1888)	2,400
One clerk, at $1,000 (same act)	1,000
Four copyists, at $720 each (same act)	2,880
	6,280

NOTE.—The following additional estimates are submitted:

Three clerks of class four, one of whom shall be employed in indexing the work, and another in the preparation of statistical tables	5,400
Two clerks of class three	3,200
One clerk of class two	1,400
Four copyists, at $900 each	3,600
One assistant messenger	720
Stationery and contingent expenses for the Office of Naval Records of the Rebellion	500
	14,820

D.

I.—SALARIES, LIBRARY, NAVY DEPARTMENT.

One clerk, at $1,000 (July 11, 1888)	1,000
One assistant messenger (same act)	720
One laborer, at $660	660
	2,380

II.—BOOKS, LIBRARY, NAVY DEPARTMENT.

For professional books and periodicals (July 11, 1888)	1,000
For professional books and periodicals, additional (submitted)	1,500

NOTE.—The amount estimated for ($2,500) is that appropriated previous to the fiscal year 1885–'86. The reduced amount is inadequate to meet the necessities of the Department.

E.

I.—SALARIES, HYDROGRAPHIC OFFICE.

Two clerks of class two (July 11, 1888)	$2,800
One clerk of class one (same act)	1,200
One assistant messenger (same act)	720
One watchman (same act)	720
Draughtsmen, engravers, assistants, computers, custodian of archives, copyists, copper-plate printers, apprentices, and laborers in the Hydrographic Office (same act)	40,000
Total	45,440

II.—Contingent and Miscellaneous Expenses.

For copper plates, steel plates, chart paper, tools, instruments, and materials for surveying, drawing, engraving, and printing; materials for and mounting charts; data for charts and sailing directions; freight and express charges; reduction of charts by photography, reproduction of charts by photo-lithography, and other processes for immediate use; electrotyping copper plates, cleaning copper plates, and other labor relating to chart-making; care and repairs of printing presses, furniture, instruments, and tools; extra drawing and engraving; translating from foreign languages; expert work in compiling and arranging data for charts, sailing directions, and other nautical publications; works and periodicals relating to hydrography, marine meteorology, navigation, and surveying	$20,000
For expert marine meteorological and other work in the preparation of the pilot chart and supplements; material for and printing and mailing the same, including postage	15,000
For rent of buildings for printing presses, storage of materials and instruments used in the construction and printing of charts, and other necessary purposes; repairs and heating of the same; and gas, water, and telephone rates	4,500
For contingent expenses of branch offices at Boston, New York, Philadelphia, Baltimore, Norfolk, Savannah, New Orleans, San Francisco, and Portland, Oregon, including furniture, fuel, lights, rent, and care of offices; car fare and ferriage in visiting merchant vessels; freight, express, telegrams, and other necessary expenses incurred in collecting the latest information for the pilot charts, and for other purposes for which the offices were established	20,000
For continuing work on a series of charts of the coast of Europe (submitted)	5,000
	64,500

III.—For Printing and Binding.

For printing and binding for the Hydrographic Office (July 11, 1888)	12,000
Total	76,500

F.

SALARIES, NAUTICAL ALMANAC OFFICE.

Salaries of asssistants in preparing for publication the American Ephemeris and Nautical Almanac, viz:

Three assistants, at $1,600 each (August 5, 1882; July 11, 1888)	4,800
Two assistants, $1,400 each (same acts)	2,800
Three assistants, at $1,200 each (same acts)	3,600
Two assistants, at $1,000 each (same acts)	2,000
One copyist and type-writer, at $900 (same acts)	900
One assistant messenger (same acts)	720
One laborer (same acts)	660
	15,480

Pay of computers on piece work in preparing for publication the American Ephemeris and Nautical Almanac, and improving the table of the planets (submitted)	8,400
Increase of three assistants from $1,600 to $1,800 (submitted)	600
	9,000

G

I.—Salaries, Naval Observatory.

One assistant astronomer (August 5, 1882; July 11, 1888)	2,000
Two assistant astronomers, at $1,800 each (same acts)	3,600
One clerk of class four (July 11, 1888)	1,800
One instrument maker (same act)	1,500

Four watchmen, including one for new Naval Observatory grounds	$2,880
One skilled laborer, at $1,000; one skilled laborer, at $720 (same act)	1,720
Seven laborers, at $660 each (same acts)	4,620
One computer (same act)	1,200
	19,320

NOTE.—The following additional estimates are submitted:

Increase to pay of one assistant astronomer, $600	600
Increase to pay of two assistant astronomers, $400 each	800
Increase to pay of instrument maker	500
Two computers, at $1,200 each	2,400
One laborer for care of compass houses	660
One copyist and indexer for the library	800
	5,760

II.—CONTINGENT AND MISCELLANEOUS EXPENSES, NAVAL OBSERVATORY.

Miscellaneous computations (August 5, 1882; July 11, 1888)	1,200
Books, periodicals, engravings, photographs, and fixtures for the library (Same acts)	1,000
Apparatus and instruments, and for repairs of the same (same acts)	2,500
Repairs of buildings, fixtures and fences, for fuel, furniture, gas, chemicals, stationery, freight, foreign postage, expressage, fertilizers, forage, plants, and all contingent expenses (July 11, 1888)	4,500
Payment to Smithsonian Institution for freight on Observatory publications sent to foreign countries (same act)	136
NOTE.—The following additional estimate is submitted:	
Extension and maintenance of the time service	5,000
	14,336

FOR THE NAVAL SERVICE.

I.—NAVIGATION.

Foreign and local pilotage and towage of ships of war; service and materials in correcting compasses on board ship, and for adjusting and testing compasses on shore; nautical and astronomical instruments, nautical books, maps, charts, sailing directions, and repairs of nautical instruments for ships of war, books for libraries of ships of war, and professional papers, naval signals and apparatus, namely, signal lights, lanterns, rockets, running lights, drawings and engravings for signal-books; compass fittings, including binnacles, tripods, and other appendages of ships' compasses; logs and other appliances for measuring the ship's way, and leads and other appliances for sounding; lanterns and lamps and their appendages for general use on board ship, including those for the cabin, ward-room, and steerage, for holds and spirit-room, for decks and quartermaster's use; bunting and other materials for flags, and making and repairing flags of all kinds; oil for ships of war other than that used in the engineer department; candles, when used as a substitute for oil in binnacles and running lights; chimneys and wicks, and soap used in navigation department; stationery for commanders and navigators of vessels of war, and for use of courts-martial; musical instruments and music for vessels of war; steering signals and indicators, and speaking tubes and gongs for signal communication on board of vessels of war; photographic instruments and materials, and for introducing and maintaining electric lights on board vessels of war (September 7, 1888)	130,000

II.—ELECTRIC LIGHTING PLANTS.

For installing the monitors *Miantonomoh*, *Terror*, and *Monadnock* with electric-lighting plants, $15,000 each (submitted)	45,000
For increasing the electric-lighting plant of the *Baltimore* (submitted)	2,600
For increasing the electric-lighting plant of the *Charleston* (submitted)	2,600
For installing the gun-boat *Petrel* with an electric-lighting plant (submitted)	5,000

For installing the dynamite-gun cruiser *Vesuvius* with an electric-lighting plant (submitted)	$5,000
For installing the receiving ship *Vermont* with an electric-lighting plant (submitted)	6,000
	66,200

III.—OCEAN SURVEYS.

For special ocean surveys and the publication thereof (September 7, 1888)	20,000

IV.—PUBLICATION OF SURVEYS—MEXICAN AND OTHER COASTS.

For preparing and engraving on copper plates the surveys of the Mexican coast and the publication of a series of charts of the coasts of Central and South America (September 7, 1888)	10,000

V.—CHARTS OF CHINA, JAPAN, AND PACIFIC ISLANDS.

For preparing and engraving on copper plates a series of charts of the coasts of China and Japan and the Pacific Islands (submitted)	10,000

VI.—NAVAL WAR COLLEGE.

For maintenance of War College; repairs and improvements on buildings; heating, lighting, and furniture for same; books and stationery; freight and other contingent expenses; purchase of fuel and maintenance of horses and mail wagons, and attendance on same (September 7, 1888)	10,000

VII.—CONTINGENT, BUREAU OF NAVIGATION.

For contingent expenses of the Bureau of Navigation, namely: Freight and transportation of navigation materials; postage and telegraphing on public business; packing boxes and materials; furniture, stationery, and fuel for navigation offices at navy-yards, and all other contingent expenses (September 7, 1888)	5,000

VIII.—CIVIL ESTABLISHMENT, BUREAU OF NAVIGATION.

Navy-yard, New York:	
one clerk (September 7, 1888)	1,400
one writer (same act)	1,000
one store-keeper (same act)	900
one master of tugs (same act)	1,500
Navy-yard, Portsmouth:	
one clerk (September 7, 1888)	1,000
Navy-yard, Norfolk, Va.:	
one clerk (September 7, 1888)	1,200
Navy-yard, Washington, D. C.:	
one clerk (September 7, 1888)	1,000
Navy-yard, Mare Island, Cal.:	
one clerk (September 7, 1888)	1,000
Naval War College:	
one clerk (September 7, 1888)	1,000
	10,000

IX.—NEW NAVAL OBSERVATORY.

For continuing the erection of the new Naval Observatory and necessary buildings upon the site purchased under the act of Congress approved February 4, 1880 (21 Stat., p. 64)	240,000

RECAPITULATION

FOR THE SUPPORT OF THE BUREAU OF NAVIGATION.

A—	I.	Salaries, Bureau of Navigation	$9,600
		Salary (submitted)	1,200
B—	I.	Salaries, Office Naval Intelligence	1,600
		Salary (submitted)	660
C—	I.	Salaries, Office Naval Records of the Rebellion	6,280
		Salaries (submitted)	14,320
	II.	Stationery and contingent (submitted)	500
D—	I.	Salaries, library, Navy Department	2,380
	II.	Books, library, Navy Department	1,000
		Professional books and periodicals (submitted)	1,500
E—	I.	Salaries, Hydrographic Office	45,440
	II.	Contingent and miscellaneous expenses	64,500
	III.	Printing and binding	12,000
F—	I.	Salaries, Nautical Almanac Office	15,480
		Salaries (submitted)	9,000
G—	I.	Salaries, Naval Observatory	19,320
		Salaries (submitted)	5,760
	II.	Contingent and miscellaneous expenses	14,336
		Total	224,876

FOR THE NAVAL SERVICE.

I.	Navigation	130,000
II.	Electric-lighting plants	66,200
III.	Ocean surveys	20,000
IV.	Publication of surveys	10,000
V.	Charts of China, Japan, and Pacific Islands	10,000
VI.	Naval War College	10,000
VII.	Contingent, Bureau of Navigation	5,000
VIII.	Civil establishment, Bureau of Navigation	10,000
IX.	New Naval Observatory	240,000
	Total	501,200

Statement of the amounts expended at the different navy-yards under appropriation "Civil establishment, 1887–'88" (third section, act January 30, 1885.

Portsmouth	$1,000.00
New York	4,770.40
Washington	999.99
Norfolk	1,199.99
Mare Island	1,000.00
Total	8,970.39

REPORT OF THE SUPERINTENDENT OF COMPASSES.

COMPASS OFFICE,
BUREAU OF NAVIGATION, NAVY DEPARTMENT,
Washington, October 10, 1888.

SIR: I have the honor to submit the following report of the work performed in the Compass Office during the past year.

In November last the twenty-six 7½-inch compasses mentioned in my last report were inspected, and in August ten more 7½-inch and thirty boat compasses which had been repaired this year were inspected and passed. They conformed to the high standard of test now applied to all navy compasses.

Eight azimuth-circles which were damaged by fire in the New York navy-yard were repaired. Messrs. Ritchie & Sons are now making six new azimuth-circles of the standard pattern. A novel form of azimuth-circle was presented by this firm for experiment. It was sent in March last for trial in the U. S. S. *Pensacola* during a cruise in the West Indies. The results of this trial were submitted in a special report to the Bureau by Capt. A. R. Yates, U. S. Navy. In view of this favorable report and the celerity with which the instrument can be used in all ordinary weather, I recommend its issue to the vessels of the Navy.

One magnetometer of the Fauth pattern was sent to the U. S. S. *Ranger*.

An exhibit of instruments belonging to this office was sent to the Cincinnati Exhibition.

Various new devices bearing on the subject of compasses have been examined, but none seemed of sufficient importance or practicability to suggest their adoption in the service.

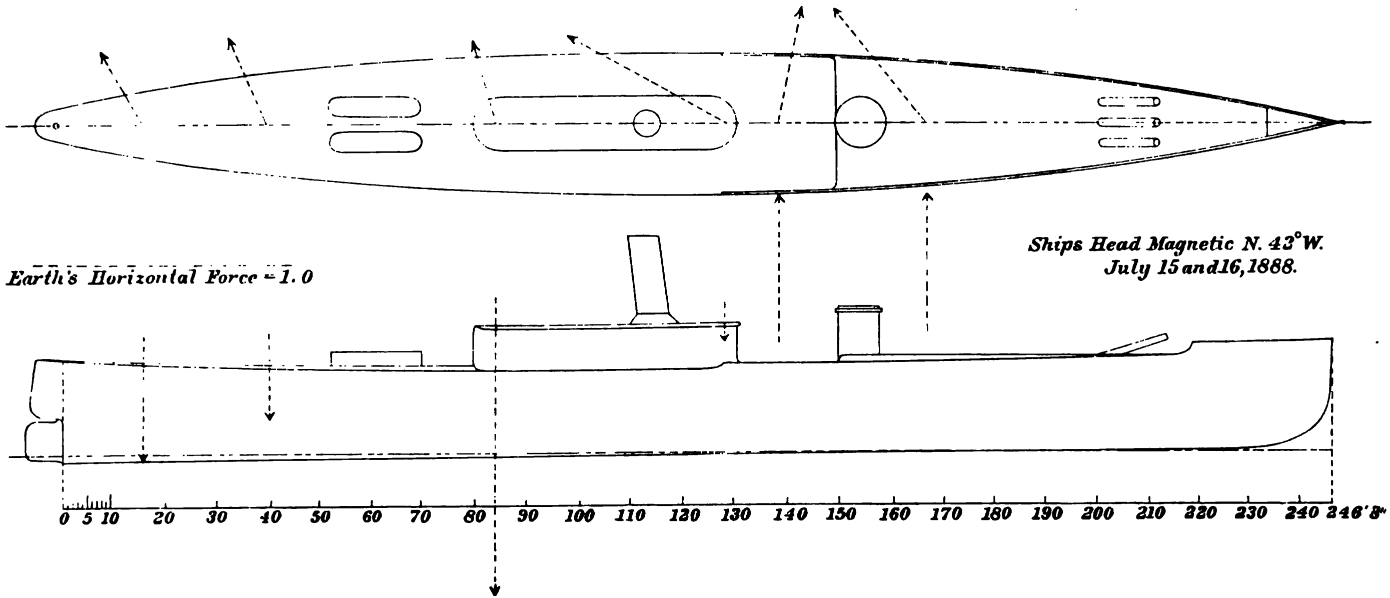
Compass reports have been received from the cruising vessels, the calculations verified, and the results filed.

Two Thomson's vertical force instruments, three clinometers (Evelyn's patent), and one Pelorus were purchased abroad. It is the intention to issue the Pelorus to ships in place of the Alidade or dumb compass, which has no gimbal attachment.

During the year all the compasses of obsolete pattern and those of the new type needing repairs have been sent to the Boston navy-yard, and I respectfully suggest that hereafter all compasses and binnacles for issue be stored at the New York and Mare Island navy-yards. Tell-tale compasses being useless on board steel or iron ships unless compensated, I would recommend that their manufacture for the Navy be discontinued.

The Messrs. Ritchie & Sons were the successful bidders for making ten compensating binnacles for the new cruisers. The internal mechanism for moving the bar-magnets has been altered, and is believed to be an improvement on the arrangement as heretofore used. The essential features of the two binnacles, however, are alike, eight magnets being used in each case. A new device for holding the heeling magnet has also been introduced. Two of these instruments have been finished and inspected, and are now in store at the New York yard ready for issue. The old binnacle was thought to be too heavy. In the new one the weight has been considerably decreased.

Experiments are now making with the view of increasing the illumination of the compass, a device being sought by means of which the light from the binnacle lamps may be concentrated on the keel-mark of the compass bowl.



U. S. DYNAMITE CRUISER "VESUVIUS."

MAGNETIC DIRECTION OF SHIP'S HEAD IN BUILDING, N. 43° W.

[Report of Secretary of the Navy, 1888—Navigation.]

Abroad, binnacles with two sets of magnets, one being fore and aft, and the other athwartships, are being generally used. With the view of getting a very light binnacle for use on board our small vessels, a binnacle was made at the Washington navy-yard in which magnets are placed as stated above. Experiments with this instrument were undertaken in this office on the model *Scoresby*, and proved that the binnacle as made was efficient. It remains in the Compass Office, and should a very light binnacle ever be required for torpedo boats, it may serve as a pattern.

The magnetic headings of all the ships now building for the Navy have been observed, and as far as possible observations have been made to determine their magnetic character. At the yard of William Cramp & Sons the vessels were built in such close proximity to each other that reliable observations were impossible. Work of this character has, however, been done on board the *Yorktown* and *Vesuvius* while fitting out in the slips, and lately some preliminary observations have been made on board the *Baltimore* on the stocks, the vessels which were alongside of her having been launched. On board the *Petrel* observations were also attempted, but as she is a small vessel it was found that the results were probably vitiated by her proximity to the pump-house of the graving-dock at the Columbia Iron Works. The records of all these observations have been placed on file in this office, where they are of easy reference, and when completed will form a magnetic history of these steel vessels. A drawing of the *Vesuvius*, showing her magnetic forces and their directions at different stations, is subjoined to this report.

In this connection I would suggest that it is almost imperative that a clause should be introduced in contracts made with the builders of our steel cruisers, requiring ships to be fitted out with head opposite to the direction of building, and that all metal fittings in the vicinity of the binnacles should be of bronze as far as possible and not of steel or iron.

In June, Lieut. G. W. Denfeld and I proceeded to Erie, Pa., and swung the U. S. S. *Michigan* for compass deviations, and with a Flinders-bar partially compensated the compass in the wheel-house, which had always given trouble owing to its large deviation, the maximum being 26°. Her standard compass, as now placed well aft on the poop, has only small deviations and does not need compensation.

The *Chicago's* compasses were recompensated while the vessel was alongside the dock in the New York yard, a large amount of ballast iron having been put on board previous to her speed trial. In the position selected for her standard binnacle on the after bridge, the compass is affected by the magnetic field of the dynamos. Another position further aft, on a platform to be built on the quarter-deck, will probably have to be selected.

As suggestive of the necessity for frequently observing the errors of the compasses even on board wooden vessels where sometimes the compasses are unavoidably placed near the funnels, I would refer to a special report on this subject made by Commander B. H. McCalla, commanding the U. S. S. *Enterprise*. On board the *Enterprise* the steering compass in the wheel-house is quite close to the funnel and is compensated by means of a Flinders-bar. Commander McCalla reports that during a four-hours' speed trial in the Gulf of Finland when the funnel was heated more than usual, although the standard compass aft showed no change in the heading, that of the steering compass above referred to changed from S. 81° E. to S. 86° E. at the end of the four-hours' run.

This change of deviation of the steering compass was undoubtedly due to the unusual heating of the iron in the funnel and the consequent partial loss of its magnetism.

Respectfully submitted.

W. H. SCHUETZE,
Lieutenant, U. S. Navy, Superintendent of Compasses.

The CHIEF OF THE BUREAU OF NAVIGATION.

REPORT OF THE INSPECTOR OF ELECTRIC LIGHTING.

OFFICE OF NAVAL INSPECTOR OF ELECTRIC LIGHTING,
BUREAU OF NAVIGATION, NAVY DEPARTMENT,
Washington, October 21, 1888.

SIR: In obedience to your order I have the honor to submit the following annual report containing a brief summary of the work performed under the supervision of this office.

The Trenton.—The plant of this ship, as described in my report of last year, has continued to perform excellent service. On one occasion the engine and dynamo were run fifteen days without stopping. The total number of lamps has been increased to 300, as follows: 193 of 10-candle power; 101 of 16-candle power, and 6 of 32-candle power.

The Omaha.—This ship was originally installed early in 1885 by the Consolidated Electric Lighting Company of New York, with a shunt-wound 75-volt and 85-ampère Sawyer-Man dynamo, a 9½ by 12-inch Armington & Sims horizontal engine and 156 16-candle power Sawyer-Man lamps. Wire, insulated with paraffined cotton, and then covered with lead, was used. In many instances this was secured by using iron staples. The dynamo was driven by means of a counter-shaft and belting. The three years' cruise of this ship terminated during the past year, and the general performance of her plant may now be briefly stated. Although the plant was generally run only from sunset to midnight, and there was a spare armature on board, the construction of the dynamo was so faulty that it was with extreme difficulty that it was kept serviceable for three years. The spindles of both armatures broke short off and were repaired. The insulation of both armatures proved to be faulty. A clever piece of work was performed on board under the direction of Ensign H. G. Dresel, U. S. Navy, who had charge of the plant, in rewinding one of the armatures. The lamp sockets proved faulty in the switch arrangements for turning off and on. The lamp wires were exposed and sometimes corroded off. The iron staples in many instances indented the lead cover of the conductors and caused a leak. The paraffined cotton proved totally inadequate as an insulator, and it goes without saying that with such an insulating substance a lead cover does more harm than good. The *Omaha* was re-commissioned at Panama for further service in China. A large amount of electric-lighting supplies were purchased for her and shipped to that port. They consisted of a new 75-volt and 128-ampère Thomson-Houston compound wound dynamo with spare armature, a large amount of rubber insulated lead-covered wire, new lamps, sockets, volt and ampère meters, testing generator, a Weston 2,000-candle power arc lamp, cut-outs, fusible strips, and numerous other small supplies. Lieut. J. B. Murdock, U. S. Navy, an eminent electrician and a very energetic officer, being ordered to the *Omaha* for duty, had charge of installing the new plant. The old dynamo was shipped to New York; the new one was hoisted on board one

night and in operation the next. The counter-shafting was done away with and the engine belt taken direct to the dynamo pulley, with 9 feet between centers, thus forming a fairly compact plant. Many other repairs and improvements have been made on board with the supplies forwarded. From the first the dynamo has worked smoothly and given great satisfaction. The arc lamp has been used for lighting up the ship when coaling at night, and for other purposes, and does not materially interfere with the steadiness of the incandescent lamps in circuit.

The New Hampshire.—As stated in my report of last year, I have never inspected the plant of this ship, as it is maintained by the Bureau having cognizance of the training station. It has been learned from the quarterly reports made during the past year that there are installed a total of 354 lamps, viz: 337 of 16-candle power; 10 of 32-candle power, and 7 of 100-candle power. The insulation of the conductors of the ship, as set forth in the quarterly reports, was evidently so poor that there was imminent danger of fire. A report to this effect was forwarded to the Bureau of Equipment and Recruiting with the result, as appears by the quarterly reports, that new conductors were installed, though the latest appliances for this purpose, consisting of water-tight incombustible junction boxes, switches, etc., were not used.

The Atlanta.—The plant of this ship continues to give satisfaction, although heavy and occupying great space. Frequently it is run a week continuously. Faults occasionally occur from bad insulation and defective fixtures. The lamps now number 292, and are all 16-candle power of the Weston type. They do not seem to be as long-lived as some other types used in the naval service. The need of water-tight fixtures for use on the battery and upper decks is much felt.

The Boston.—The plant of this ship as originally installed and described in my last report has not given satisfaction. The armature of the dynamo is of large diameter and has frequently chafed against the pole pieces, necessitating repairs, and even dressing down the pole pieces one-sixteenth of an inch. It has been found impossible to prevent considerable sparking at the commutator, and one set of brushes and commutator segments, used with the greatest care, will last only from six to eight weeks. The dynamo also heats too much to be fully efficient, when running with full load, and in this connection it may be remarked that the dynamo room is deficient in ventilation, the temperature in summer varying from 100° to 120° Fahrenheit. This high temperature has a very marked effect in decreasing the electro-motive force of the dynamo. The faults that occur in the installation generally arise from defective insulation of the conductors, from the want of efficient water-tight junction boxes and switches and water-tight fixtures. The conductors used to install this ship and the *Atlanta* are deficient in insulation and must be replaced in the near future. The engine, as stated in my last report, has not proved satisfactory, being entirely too heavy, frequently breaking down and without satisfactory lubricating apparatus. It is much better calculated for land surface than marine work. There are now a total of 269 Swan lamps on board, 81 of 8-candle power and 188 of 16-candle power. This type of lamp gives great satisfaction both in length of life and illuminating properties.

Recently the Brush Company has removed the original plant of the *Boston* and substituted another of the following brief description : The dynamo is practically the same so far as its electrical dimensions are concerned, but it is hoped it will prove to be of better workmanship; instead of having a belt pulley on the end of the armature there is a compressed raw-hide pinion. The engine is of the Armington & Sims horizontal

double-cylinder type, fitted with a cast-iron geared wheel, which engages the raw-hide pinion of the dynamo. The engine cylinders are 7 by 5 inches, and the gearing $2\frac{6}{10}$ to 1. The new engine and dynamo weigh about 3,500 pounds, and the old about 10,400 pounds. The deck space occupied by the new plant is 4 feet 3 inches by 6 feet 6 inches; that occupied by the old 4 feet 3 inches by 17 feet 5 inches. This plant has not been running long enough to decide upon its value, though at present it is very promising. The double cylinder Armington & Sims engine promises well for driving dynamos. It is very light and compact; it runs very smoothly and without noise, and its automatic governor is very efficient.

The Chicago.—The installation of this ship has been completed during the past year. It consists of two Edison compound wound dynamos of 105 volts and 160 ampères and two Armington & Sims horizontal single cylinder $12\frac{1}{2}$ by 10 inch engines. The dynamos are driven by short but very broad belts. The plant occupies a space of 20 by 6 feet and weighs 18,300 pounds. It was the most compact and the best adapted for marine work of any that could be obtained at the time the contract to install the *Chicago* was made. Though not yet tried by actual service, the ship not having been commissioned, it performed in a very satisfactory manner, each dynamo and its engine having made a continuous run of one week without accident or heating while being tested for acceptance. There are on board a total of 438 Edison lamps, made up of 121 of 10-candle power, 303 of 16-candle power, 8 of 32-candle power, and 6 of 50-candle power. With the exception of the fixtures, the fittings of this installation are very complete and of a superior character, and it is confidently expected that they will be very serviceable. The insulation resistance of the entire system is above 100,000 ohms.

The Yorktown.—The contract of Messrs. William Cramp & Sons, Philadelphia, Pa., for building this ship requires that she shall be lighted by electricity. The specifications for the installation were prepared in this office, accepted by the builders, and a contract made by them with the Edison United Manufacturing Company, 65 Fifth avenue, New York, to perform all work connected therewith, and furnish all supplies except the fixtures. The latter are being made under my supervision by Messrs. Williams, Page & Co., 24 Beach street, Boston, Mass., in accordance with a contract made by that firm with the Messrs. Cramp & Sons. The work of installing the *Yorktown*, now well advanced, is under the supervision of Lieut. T. E. DeWitt Veeder, U. S. Navy, as resident inspector. This ship will be supplied with two compound wound dynamos, each of 80 volts and 100 ampères, two Armington & Sims double cylinder and double acting horizontal engines, each directly connected to its dynamo by means of a flexible coupling. The engines will work at 60 pounds pressure and cut off at one-quarter stroke.

Ample precautions have been taken to insure efficiency, economy of space and weight, and noiselessness. The plant will be placed well below the water line, and the dynamo room will be well ventilated by means of a fan driven by an electric motor. The insulated wire being used in this ship is of excellent quality, and was manufactured by W. M. Habirshaw, 159 Front street, New York. Lengths 500 feet long, both with and without the lead covering, have been carefully tested in the laboratory at the Naval Academy and found, after having been immersed in sea water several days, to possess an insulation resistance of 2,000 megohms. All of the appurtenances of the installation are of the best quality, and much credit is due to Messrs. Cramp & Sons for obtain-

ing the best supplies and material in the market. It is confidently expected that this installation when complete will be equal if not superior to any in the world.

The Baltimore.—Detailed specifications for the lighting plant of this ship have been prepared in this office and accepted by Messrs. Cramp & Sons. They have, as in case of the *Yorktown*, closed a contract with the Edison United Manufacturing Company to install the ship, but work on her has not yet been commenced, although the dynamos and engines and some of the other materials are now being manufactured. The plant will consist of two sets of dynamos and engines, each of the same voltage but double the output of those for the *Yorktown*, with the possible addition of a third set later. The engines will be the same size as those for the *Yorktown*, but will work with a normal pressure of 80 pounds, cutting off at one-quarter stroke. The specifications for this ship are mainly like those of the *Yorktown*, with a few improvements suggested by experience. This installation will also be under the supervision of Lieutenant Veeder, U. S. Navy, as resident inspector.

The Charleston.—This ship is required to be lighted by electricity by her building contractors, the Union Iron Works, San Francisco, Cal., but the details of the work have not yet been agreed upon. Mr. Irving M. Scott, the general manager of the Union Iron Works, has informed this office that he proposes to use vertical engines of the Allen type, manufactured by the firm, and that he has contracted with the Edison United Manufacturing Company for two dynamos similar to those designed for the *Baltimore.*

The Pensacola.—This ship is now being refitted as a flag ship and will probably be serviceable as a peace cruiser for several years, and after that has a prospective career as a receiving ship. For these reasons it was thought very desirable to install her with a single lighting plant of moderate cost. Accordingly detailed specifications were prepared in this office and bids in accordance therewith advertised for. The lowest bidder was the Edison United Manufacturing Company, 65 Fifth avenue, New York, with which a contract has been made to do all work and supply all materials. This ship will be installed with one 80-volt 200-ampère compound wound dynamo, making 400 revolutions per minute, driven by an Armington & Sims engine, directly connected with the usual flexible and insulating coupling. The engine will be of the same pattern and size as those for the *Yorktown*, having cylinders 7 by 5 inches, and working with a normal steam pressure of 60 pounds, but cutting off at one-third stroke. There will be a total of about 268 lamps installed. The wire being used is of the *Yorktown* pattern, and all materials and appurtenances will be of the best quality and design. The installation is required to be completed and running in seventy days from signing the contract. Lieut. A. W. Grant, U. S. Navy, is the resident inspector in charge of the work.

Electric conductors in ships.—My recommendation of last year concerning the proper supervision of the installation of all electric conductors on ship-board, for whatever purpose, is renewed. In accordance with this recommendation this office was asked to suggest the electric signal apparatus for the *Yorktown*, which was done, including therein a "slide steam-whistle" for use as a signal for closing water-tight doors. The conductors for the electric signal apparatus of the *Yorktown* were selected by me, and are insulated with rubber of excellent quality. They are being inclosed in wooden molding where led about the ship, and therefore will be protected and accessible. The supervision of this work, as well as the selection of the signal apparatus, is

performed by the resident electric-light inspector, and the increased efficiency of the entire signal installation will be very great. It would be very advantageous for the ship if the search light, torpedo, and gun-firing wires were put up at the same time and under the supervision of the same officer, since he is not only an expert in the performance of this duty, but would keep all separate, a very important essential, and cause one to give way in space to another in accordance with the relative importance of each. The success of all electric apparatus very largely depends upon a careful attention to details, and the greatest difficulty by far that has ever been experienced with such apparatus on board ship is caused by faulty conductors badly installed.

Search lights.—The Gramme search-light plants of the *Trenton*, *Atlanta*, and *Boston* are occasionally used for incandescent lamps at times when the incandescent plant is being overhauled. By coupling the two Gramme dynamos in series they will maintain from forty to fifty 16-candle power lamps continuously without overheating. By regulating the revolutions of the Brotherhood engine, the proper electro-motor force, as indicated by the volt meter placed in circuit, can readily be maintained. The *Chicago* has been installed by the Bureau of Ordnance with a search-light plant similar to those above mentioned. The 80-volt compound wound dynamo adopted by the Bureau of Navigation in May, 1887, and now being installed in the new cruisers, as already described, will, it is confidently expected, be very efficient for search lights. Search lights are at times very useful, but discretion must be exercised as to when and how to use them. During the recent English evolutionary squadron exercises, the search lights of the blockading squadron failed to detect the escaping ships of the enemy, which had, of course, all lights out and everything visible carefully colored a dead black. On the other hand, the enemy's ships which were not trying to escape used their search lights to blind the eyes of the blockaders and interfere with the rays of their searchers. Recent experiments in Russia indicate that it is not an easy matter to disable a search light with machine guns and shoulder rifles, on account of the light blinding the eyes and interfering with the aim. It is found in Germany, however, that if search lights are placed behind men with the beam of light on a target, very good practice can be made, so long as the men are in the beam, the sights of the guns then being illuminated: if, however, the men are out of the beam, and consequently invisible, the accuracy of the practice is much reduced. On the whole, search lights promise to be a very useful adjunct on any sized vessel designed for warfare.

Electric lights at naval stations.—I desire to call attention to my recommendation of last year that the large and important navy-yards be lighted by electricity. The advantages are many, and among them may be mentioned the facility furnished by the electric current for the transmission of power. But little demand would exist for electric lights in the day-time, and therefore a large current would be available for other purposes. This can, by means of small and portable motors, be made extremely valuable for working drilling and other machines, requiring but little power, that are used in ship construction and for other purposes. As a matter of fact the need of small power-motors which are perfectly portable, for use where steam-power is inaccessible, has long been felt. Arc lamps should be used for outside lighting and in large sheds and shops, while incandescent lamps should be used in offices, houses, and generally for inside work. I am prepared to recommend the best systems for this purpose. The scheme for the entire plant should be carefully and completely laid down before commencing, in

order that the work of installation may be strictly progressive. The wires should be laid underground and have ample conducting area. Posts for arc lamps should be carefully placed and spaced and arranged so as not to cast shadows from their own lamps; they should also be so arranged as to render it impossible for any person to receive a shock from the high potential current used with arc lamps. There should be duplicate dynamos and engines in a plant of this kind for simplicity in working and on account of spare parts. Provision should also be made for spares and for portable cables and lamps to be taken wherever an emergency may call for night work. The specifications for a navy-yard installation should be very carefully drawn in order to exclude the wretched and dangerous materials and workmanship so frequently found in electric light plants.

Receiving ships.—On account of the careful and strict police regulations required in these ships, where there are frequently large bodies of men and raw recruits, the latter often including men of vicious and dishonest character, the advantages and need of electric lights are great. These ships are generally supplied with boiler power, and therefore an electric lighting plant can be installed at moderate cost and economically maintained.

Demand for electricity on board ship.—The tendency now is to install all ships and even torpedo-boats with electric lights, and to increase the power and number of search-lights. The use of incandescent lamps is found to very materially assist in rendering torpedo-boats habitable. It is reported that in the English navy the dynamo-rooms, located below the water line, are so warm and uncomfortable, in several instances, that dynamos for incandescent lighting are being placed on the upper decks for use when not in action. It is thought that this difficulty can be overcome in our ships by the use of fans driven by electric motors. It is not improbable that small electric motors for some other purposes may be required, but it is not likely that they will be used to any great extent on account of a want of economy, and because their use would require very large electric plants without in any way reducing the boiler capacity or other machinery of the ship. The peculiar function of electric motors is for places where the power is so small that the slight loss in economy is more than overcome by the facility afforded for transmission, where the transmission is for a long distance, and where other motors are inaccessible or not portable.

Office and clerical force.—The present inspector having been assigned as assistant to the Chief of Bureau of Navigation, Navy Department, in addition to other duties, the office formerly occupied at Newport has been given up. For the want of a suitable place to keep them, the plans, models, samples, records, etc., formerly in the Newport office, are now packed and stored. For the want of clerical assistance, none being available except those fully occupied with other duties, letter-books are not indexed, and official letters are tied up in bundles. I therefore desire to renew my recommendation of last year, that a stenographer and typewriter be allowed the inspector. An office exclusively devoted to this duty is also absolutely necessary. Attention is called to the fact that in the English navy the electric lighting of ships is in charge of a commander attached to the admiralty, who has a large staff of assistants.

Very respectfully, your obedient servant,

R. B. BRADFORD,
Lieutenant Commander, U. S. Navy,
Naval Inspector of Electric Lighting.

The CHIEF OF THE BUREAU OF NAVIGATION.

REPORT OF PRESIDENT OF NAVAL WAR COLLEGE.

UNITED STATES NAVAL WAR COLLEGE,
Newport, R. I., October 13, 1888.

COMMODORE: I have the honor to submit the annual report of the work of the Naval War College.

The fourth annual session opened August 6, 1888. The intended programme, as blocked out by the president of the college and undertaken by the different lecturers, is hereto annexed. The greater part of this course has been realized, though some reduction has been necessitated by the order of the Navy Department limiting the time to three months, on account of the great scarcity of officers for active service. The development of the course having followed the lines already indicated in former reports, there is no call for further explanation here.

Congress having provided that the college may be consolidated with the Torpedo Station, the expression of the deliberate views to which I have been led, by two years of steady work and thought directed to this single object, are in place.

The word "consolidation" is of elastic meaning, while the institutions which it is thus proposed to consolidate have very different objects, and call for very different methods and habits of thought. If by consolidation is meant providing a common head and central administration for two undertakings in close local proximity, the question is one of detail and economy, of subordinate importance, and consequently not vital. But if by consolidation is meant the merging of two lines of thought radically distinct and in temper of mind opposed under a single directing intellect, the result will be the destruction of one or the other.

The present predominant tendency of the naval mind, as evidenced by the literature in which it finds expression and the work on which its practical energies are expended, is toward mechanical progress and development of material, rather than toward the study of the military movements which that material is to subserve. The work of the torpedo station is one manifestation of this tendency, and the officers who are associated with its successful progress feel that even the moderate amount of teaching now done is rather a hindrance to its advance.

The conduct of war, on the other hand, which is the object of the college, from the management of single ships up to that of a naval campaign or the naval policy of a country, is affected by conditions wholly different from those which modify the action of the materials from which the naval weapons are made, under the stresses to which they may be subjected; and hence the habits of mind and interests engendered by the pursuit of physical research or of mechanical invention tend more and more to diverge from and to look coldly upon the investigation of the problems of war.

In this age of specialties the two pursuits will rarely be reconciled in the same individual; still more rarely in the same teacher. If consolidation means that the development of the art of war and of torpedo manufacture are to be carried out by the same man, one or the other will dwindle and disappear, and the sufferer will be the art of war, because, though of the first importance, it is less consonant to the present temper of the age and, as yet, of the Navy; it is younger, weaker, more unfriended. But if the consolidation take the shape of two mutually independent branches united under a common administrative head, the change from the present arrangement, whether it turn out well or ill, will not be necessarily fatal to either.

In conclusion I will refer to the frequent assurances received of the growing approval given to the college, and the appreciation even of the partial results so far attained by the officers of the Navy. It has aroused attention to a defect in our naval thought, and at the same time given promise of remedying the evil which it has pointed out. Suitably encouraged, it will prove a powerful instrument in the hands of the Government to perfect the officers of the future in that most important of their functions, viz: the direction of operations of war at sea.

Very respectfully, your obedient servant,

A. T. MAHAN,
Captain U. S. Navy, President War College.

Commodore J. G. WALKER, U. S. Navy,
Chief of Bureau of Navigation.

PROGRAMME OF NAVAL WAR COLLEGE FOR SESSION OF 1888, BEGINNING AUGUST 6.

Naval history considered with reference to the effect of naval power upon general history; indicating the strategic bearing of naval power as a particular factor in general wars, and discussing the strategic and tactical use of the naval forces on their own element, as illustrative of the principles of war—Capt. A. T. Mahan, U. S. Navy.

The true naval conditions during the war of 1812, at home and abroad, on the sea and on the lakes, and their bearing upon the course of the war, on both frontiers and on the ocean—Theodore Roosevelt, esq.

Naval gunnery; the practical use of the gun at sea and the tactical power and limitations of the weapon—Lieut. J. F. Meigs, U. S. Navy.

Present condition of commerce and commercial sea routes between the Atlantic and Pacific, with an estimate of the effect produced upon them by a trans-isthmian canal, including a view of the military and political conditions of the Pacific Ocean, Gulf of Mexico, and the Caribbean Sea—Lieutenant-Commander C. H. Stockton, U. S. Navy.

Naval strategy—Capt. A. T. Mahan, U. S. Navy.

Strategic features of the Pacific Ocean and Pacific coast of the United States—Lieutenant-Commander C. H. Stockton, U. S. Navy.

Strategic features of the Gulf of Mexico and the Caribbean Sea—Capt. A. T. Mahan, U. S. Navy.

Strategic study of the lake frontier of the United States—Lieut. C. C. Rogers, U. S. Navy.

Strategic study (outline) of the sea-coast of the United States from Portland, Me., to and including Chesapeake Bay—Capt. A. T. Mahan, U. S. Navy.

Coast defense and attack—Lieut. D. Kennedy, U. S. Navy.

Defense of the sea-coast of the United States—General H. L. Abbot, U. S. Engineers.

Military history, strategy, and tactics—Lieut. J. P. Wisser, U. S. Artillery.

Tactics of the gun—Lieut. J. F. Meigs, U. S. Navy.

Tactics of the torpedo—Lieut. D. Kennedy, U. S. Navy.

Tactics of the ram—Commander P. F. Harrington, U. S. Navy.

Fleet battle tactics—Capt. A. T. Mahan, U. S. Navy.

Naval war game—Lieut. McCarty Little, U. S. Navy.

Naval reserves and the recruiting and training of men for the Navy—Lieut. S. A. Staunton, U. S. Navy.

Naval logistics; maintenance of coal, ammunition, and other supplies to a fleet acting at a distance; establishment of depots and chains of seaports—Lieut. C. C. Rogers, U. S. Navy.

General staff; intelligence branch; foreign war colleges and staff academies, their relation to the general staff; intelligence systems of foreign armies; general consideration of naval intelligence departments at home and abroad; meaning of naval intelligence in detail; strategic value of trade routes; their defense and attack in war; reconnaissances; reasons for general staff; essence of intelligence work is preparation for war—Lieut. C. C. Rogers, U. S. Navy.

Preservation and care of iron ships, and injuries to which they are liable; the ship considered as a gun platform—Naval Constructor R. Gatewood, U. S. Navy.

Naval hygiene—Medical Director R. C. Dean, U. S. Navy.

International law, treated with special reference to questions with which naval officers may have to do—Prof. J. R. Soley, U. S. Navy.

REPORT OF THE HYDROGRAPHER TO BUREAU OF NAVIGATION.

UNITED STATES HYDROGRAPHIC OFFICE,
BUREAU OF NAVIGATION, NAVY DEPARTMENT,
Washington, October 15, 1888.

SIR: In submitting the following summary of the work of this division of the Bureau of Navigation for the fiscal year ending June 30, 1888, it is due to my predecessor, Commander J. R. Bartlett, to state that his term closed on the first day of the month just mentioned. It is but a small tribute to say that his unvarying interest, his active and intelligent participation in all the details of the work, and his willingness to assume responsibility, were the necessary requisites for the position of Hydrographer when he took charge. The results of his administration speak for themselves, and this office lost its most successful director when he left, of his own choice, to lend his talents elsewhere.

The Hydrographic Office has now made a place for itself in the estimation of the maritime community never before occupied by any bureau of the Government. With the growing necessities of American commerce and the increased knowledge of scientific subjects relating to navigation, this office has a most useful function to perform, and its value hereafter must depend entirely on the degree to which these necessities are comprehended and appreciated, and upon the successful adaptation of means at disposal for satisfying them. The idea prevailing to a certain extent that the Hydrographic Office can run itself, so to speak, which controlled its operations for many years, is founded on a misconception of the present scope of its work and the possibilities of its development in the future. There is much to be accomplished; the field of usefulness is practically unlimited, and to do it even a scant justice will require the devoted efforts of many minds. The practical application of this, and its ultimate purpose kept steadily in view, are to give value to the peaceful operations of the Navy and increase its strength with those classes, both ashore and afloat, which are its chief supporters during times of peace and its main dependence during war. There is a degree of responsibility, therefore, attached to this work, to the Navy on one side and the maritime community on the other, which should be neither regarded lightly nor undertaken as a matter of mere routine.

By the transfer of the collection and dissemination of all matters relating to the ocean and the withdrawal of the officers of the Signal Service from ship visiting, and from the maritime exchanges, accomplished during the last year, the development of the subject of marine meteorology has been restored to the office where it was first systematically commenced, and which is the natural custodian of its records. By means of the Pilot Chart the latest practical results of this important study are now given to the world, and the Navy can lead in a matter which, with its corps of scientific seamen, it is naturally expected to do.

The branch offices keep touch with the merchant marine, and it is safe to assert that no measure ever adopted by the Navy Department

has had such influence in bringing about and maintaining pleasant relations with this class of our fellow-citizens.

The chart service of the ships of war in commission, including the necessary publications, has been commended on all sides. The fact that the Hydrographic Office is the servant of the fleet is not lost sight of for an instant, and it is now well recognized on board ship that the best charts and the latest editions of them are provided with as much celerity and certainty as the mails and express will allow. It is also gratifying to know the appreciation of those who make surveys, observations, and reports from the ships of war in finding their results published within a short time of receipt and sent out to all parts of the world as the work of American naval officers.

In regard to internal matters we have taken a long step in advance in the construction of instruments for engraving and in extending the usefulness of electro-deposited plates. The lack of room prevents the adoption of many plans which would result in a large saving and finer work. The long distance between the different divisions of the office makes it necessary to exercise greater attention, at the expense of much time, in maintaining the proper co ordination for complete and harmonious results, and also renders the problem of the most efficient and economical distribution of the force a difficult one. The greatest need of the office at present is a specially constructed fire-proof building, with sufficient and proper light for the draughtsmen and engravers, proper room for power-worked printing and lithographic presses, electrotype and photographic plant, chart mounting and drying machinery, storage for surveying instruments and supplies, and space for plates, archives, and records. The latter are valuable and could not be replaced.

No time can be set when this work will be finished. As the number of engraved copper plates increases a greater force will be required to care for them. Surveys and resurveys will be necessary as long as the world lasts and the charts that result are constantly undergoing correction and change. The growth of commerce and the evolution of ships and machinery bring in new conditions which necessitate refinements in the instruments used in navigation. Progress in the science of cartography enables the chart-maker to simplify his delineations so that the style formerly used would not be accepted by the navigator of to-day. With the expansion of commerce also a better class of observers of marine meteorology has appeared and the work on this subject will naturally increase. In order, therefore, to keep up with the requirements of the situation there must be no lack of industry, ingenuity, and business capacity and no expectation that a time will be reached when the operations of this office can be successfully conducted in a perfunctory manner.

Nothing could have been accomplished either by my predecessor or myself had you not given support to the projects for reform and expansion which have been carried out during the past few years, and among the evidences of the progressive and liberal administration of the Bureau of Navigation the present reputation of the Hydrographic Office is one of the most conspicuous.

CHART CONSTRUCTION.

The work of this important division has been carried on in a satisfactory and expeditious manner. Sixty-three new charts were published, the general localities of which were mainly in the West Indies and Central America, Newfoundland and the Gulf of St. Lawrence. The results of the work of the U. S. S. *Ranger* on the west coast of

Mexico and Lower California are included—the several harbor charts referred to in the last annual report, having been completed.

One hundred and seventy-three chart plates have been corrected and two miscellaneous plates completed during the year. In addition, there are fifty new charts in course of construction. Twenty altos and five bassos of engraved plates were made, nineteen blank plates purchased, and twenty-five rendered serviceable by scouring down and polishing condemned plates. Thirteen engraved plates were withdrawn from use and the number now on hand is four hundred and forty-one available for printing. There are also one hundred miscellaneous plates. The total number of copies of charts printed amounted to 21,659, an excess of 1,246 over the number for the preceding year, and almost double that for the fiscal year of 1882-'83.

The work upon the record of longitudes and the collection and discussion of data for the investigation of magnetic variation has been continued. This has been carried on with reference to those parts of the world not embraced in the United States and Europe. The investigations bear intimately upon the cartographic operations of the office, and have improved materially its nautical publications. Lines of equal variation appear upon the new charts of the North and South Atlantic Oceans. For the former eighteen hundred and sixty-three reliable observations at sea were collected and compiled, and these, with the predicted values at shore stations, were used to deduce the general equation.

All those features which are the same on every chart, such as the seal, marginal lettering, rims of degree compasses, etc., are now transferred to the copper plates in a small fraction of the time formerly taken to engrave them, from hardened steel rolls bearing them in alto.

Work upon the gnomonic charts has been continued. That for the Indian Ocean was finished early in the year, and the plate used to reproduce, by electrotyping, those for the North and South Pacific Oceans. The drawing for the chart of the North Pacific is now completed and that for the Indian Ocean is well advanced. It is expected that this series of great-circle sailing-charts will be published during the next year.

The work of collecting the reliable deep-sea soundings of the Indian Ocean has been outlined on six sheets. The sounding sheets of the Atlantic and Pacific Oceans and the Caribbean Sea have been plotted and brought up to date, and a sheet covering the area of the Gulf of Mexico is in course of preparation.

An outline of work for the ensuing fiscal year is included in the report of the chief of the division, which is appended.

The force of the division is as follows: One lieutenant in charge, 11 draftsmen, 15 engravers, 3 apprentice engravers, 3 printers, 1 apprentice printer, 4 laborers, 1 recording clerk, and 1 copyist.

DIVISION OF SUPPLY.

In this division there are deposited copies of 435 plate and 301 photolithograph charts, an aggregate of 736 Hydrographic Office charts. Coast and Geodetic Survey charts are ordered only in such quantities as are necessary to meet the demand for supplying United States naval vessels. Corrections are constantly being made on all the copies in accordance with information received from every source relative to the localities they cover. When the limit of economical hand correction is reached new editions are issued from the corrected plate.

The issue of charts this year exceeds that of last year by 2,794 copies, and the number sold, also, is greater by 832 copies.

As referred to in previous reports, the photolithographs are being gradually superseded by new engraved charts covering the same localities.

The number of copies of charts issued to agents during the year was 8,034, and to naval vessels, through the division of issue, 6,233. The number of copies of canceled charts condemned was 2,125, a large majority of which were the photolithographs, fast becoming obsolete. The total number of copies, including Coast and Geodetic Survey publications, sent out from this division during the year was 24,127, of which 313 copies were deposited in the archives.

The force, during the most of the year, has consisted of 2 lieutenants, 1 ensign, 3 draftsmen, 1 clerk, 1 colorist, and 1 laborer.

DIVISION OF ISSUE.

From this division is issued direct the supply of charts to all naval vessels, embracing the publications of the Hydrographic Office, Coast and Geodetic Survey, and British Admiralty. It has also special charge of British Admiralty charts, which are kept constantly corrected to date, in accordance with the latest information received.

Outfits were furnished to naval vessels as follows: *Enterprise* and *Lancaster*, European Station; *Nipsic*, *Trenton*, *Dolphin*, *Albatross*, and *Swatara*, Pacific Station; *Swatara* (having returned the Pacific charts), South Atlantic Station; *Pensacola*, North Atlantic Station.

Partial outfits were also furnished the following vessels: *Boston* *Chicago*, *Pensacola*, *Michigan*, *Constellation*, and *Terror*.

Two sets of charts, covering the Atlantic coast from the boundary o Maine northward, were furnished the Senate Committee on Foreign Relations.

In the tabular statement of the chief of this division will be found lists of charts received and issued, the recording and handling of which, with their corrections, keep the small force constantly occupied.

In addition to the regular work the catalogue of charts for the North Atlantic Station was revised and republished.

The total number of copies of charts received from all sources during the year was 12,114, of which 6,078 were from London.

The number of copies issued to naval vessels from this division was 8,830 and through B. F. Stevens, London, 1,748, making a total of 10,538; of these 5,572 were copies of British Admiralty charts.

The total number of copies of British Admiralty charts on hand is 10,435, the number condemned during the year being 1,638.

The force of the division consists of 1 ensign (in charge), 2 draftsmen, 1 copyist, and 1 laborer.

DIVISION OF SAILING DIRECTIONS.

At the beginning of the year the divisions of books, archives, notices, and mailing, were consolidated under the general head of division of sailing directions. The division of marine meteorology having been assigned a portion of the space occupied by the division of books much time and work was expended in re-arranging and cataloguing the publications.

Sailing directions of the west coast of Mexico and the Indian Ocean have been completed and issued; three others are either in the hands of the Public Printer or are ready for publication. The importance of pushing the work of publishing a complete set of sailing directions by

the Government has been dwelt upon in previous reports. The force of this division is insufficient to carry on the work which falls to it, and it should be increased whenever the appropriations will admit.

A list of such works as have been purchased, as necessity demanded, and placed in this division for issue, as well as the publications of this office for the year, is included in the appended report of the chief of the division.

The number of copies of books on hand for issue July 1, 1887, was	36,7[illegible]
Received during the year	[illegible]
Total	45,[illegible]
Number issued during fiscal year	6,[illegible]
Remaining on hand July 1, 1888	38,[illegible]

The work of issuing the weekly notices to mariners and the extracts of the same has been continued. The plan of grouping together such paragraphs as refer to the same general locality and issuing these in the form of extracts has met with such approval that no fewer than 431,700 copies were issued during the last fiscal year, and this number has now reached at least one-half million yearly. The work of the branch offices is somewhat increased by this, but the method is so acceptable to the maritime community that it should be continued. Although but one notice to mariners is published each week the number of paragraphs has increased very considerably. This large supply of nautical information distributed throughout the world has a humanitarian as well as commercial value of great significance. Large numbers of notices are constantly received from France, England, Germany, Italy, and other foreign nations. The work of translating these has been done in this division, and, re-arranged, they appear again in the notices issued from this office. In addition, data derived from foreign documents, information from ships, etc., contribute to the general fund.

The contents of these notices are tabulated and at the close of the year 800 copies of this index are issued to recipients, who keep the notices filed for binding in book form.

The six volumes of light lists have been thoroughly overhauled, revised, and corrected to date, and are ready for publication.

In the subdivision of archives 1,140 documents have been indexed and 2,495 charts catalogued. The records of all original surveys, reports, and hydrographic information of every description is filed here; copies of Coast Survey and Hydrographic Office charts, and nearly 12,000 copies of foreign charts are catalogued and arranged, embracing all those issued by foreign hydrographic offices. The classification and arrangement of these various documents and numerous sources of information has been very efficiently performed by the custodian in charge.

During the greater part of the year the force of the division has consisted of one lieutenant-commander (in charge), three lieutenants, three clerks (compilers), one custodian, and two laborers.

DIVISION OF MARINE METEOROLOGY.

All the available force of this division has been employed in routine work, the issue of the monthly Pilot Chart and weekly supplement, the proper handling of forms and journals used in the collection of data for these publications, the value of which to commerce proves the importance of still further extending the work until it embraces every ocean which American commerce is likely to reach.

The great popularity of the Pilot Chart and its supplements and its importance to the maritime world generally is apparent from the fact that over 5,000 copies are issued monthly. The reports of the officers in charge of the branch offices, to which a great portion of its success is due, show the estimation in which it is held and the appreciation of its extensive and varied information. Reports are constantly received at these offices of the success attained by following the directions laid down upon the charts, especially those for the avoidance of West Indian hurricanes. The record of floating wrecks, also, is another of the special and important features of these publications, and affords an excellent opportunity for studying the various phases of ocean currents. The great log raft, when abandoned off Nantucket Shoals, was directly in the track of transatlantic steamers, but, fortunately, it broke up before causing disaster. The drift of the logs has been plotted each month to the eastward as far as the Azores, the general track of all derelicts and wreckage which can be traced to that part of the ocean lying southwest of the Azores and south of Bermuda. These various menaces to navigation being reported to the Bureau are destroyed whenever practicable and the dangers removed from the routes of vessels.

Illustrative of this is the following extract from the New York Maritime Register of July 3, 1888:

> On June 14 the attention of the Navy Department was called to the dangerous character of the derelict steamer *Eureka*, sunk about 56 miles east-southeast of Cape Henry. On June 19 this derelict was blown up by the U. S. S. *Despatch*, so that the least depth of water over the stumps of the masts is 4½ fathoms. This is prompt work, for which the Secretary of the Navy and the chief of Bureau of Navigation are to be commended. Their action will certainly meet with the hearty approval of the shipping community, and will be taken as evidence that, as far as the Navy Department can do so, our coasts will be kept as free as possible from derelicts. The Navy is worth more than the money it costs.

An additional feature of these publications has been the issuing of a monthly supplement whenever some subject of special interest demands it. In September, for instance, a supplement was issued descriptive of West Indian hurricanes and the laws of storms; in December a discussion of the best transatlantic routes and the winter storm belt of the North Atlantic; in March a description of the water-spouts off the Atlantic coast of the United States during January and February. All of which have been and still are in great demand by masters of vessels. A monograph of the great storm off the Atlantic coast of the United States March 11-14 is in the hands of the printer.

An important improvement is the preparation and issue, in large quantities, of sets of forms upon which to record reports of marine meteorology; by this means a whole month's data can be recorded upon one sheet. The system has greatly facilitated work on board ship and in this office. Co-operation with the United States Signal Service has brought about a system by which data are exchanged and utilized by both offices without duplication.

Reports of marine meteorology are now regularly received from forty-six Government vessels, and five hundred and forty-four of the mercantile marine, and fully thirty vessels a month are added to the list. Although a majority of them navigate the North Atlantic, yet reports are received from vessels in every ocean, and only a suitable incentive and means to utilize the data are necessary to build up the best possible system of marine observations. During the year one hundred and seventy-six meteorological journals have been received and one hundred and ten new ones issued. More than fifteen hundred of these journals

were on hand, containing valuable data relating to the navigable waters of the globe, but at present useless to the maritime community on account of the lack of means to properly collate and publish them.

Interesting reports on the use and efficacy of oil in lessening the dangerous effects of heavy seas are regularly received, and only confirm what is now so generally known. So widely is this fact established and accepted that there are now in the market many ingenious contrivances for the proper distribution of the oil in times of emergency.

The report of the officer in charge of this division is appended, and a perusal of it will show the importance of increased attention to the question of marine meteorology. The building up of an efficient, well-organized, and valuable division upon the excellent foundation now established only awaits the proper support of Congress.

BRANCH OFFICES.

Very satisfactory reports have been received from all the branch offices, showing such an increased scope of operations that the present quarters occupied by them and the force employed is altogether in cient.

Boston.—The Boston office reports that the publication of the water spout supplement has had considerable effect in calling the attention mariners to that subject, and has aroused them to the importance making more careful observations of these phenomena. The excellen of the new sailing charts has been commended by the sea-faring com munity, and were not the masters of many of the foreign steam lin obliged by law to use the charts issued by their own governments ma of them would take the Hydrographic Office charts in preference. T "Fishery Limits" chart has proved to be most acceptable to the fish men, and has undoubtedly served to keep many out of trouble. T work of collecting data has been much simplified by the new forms recording Greenwich noon observations, and the returns have been fai good on an average, many of the records showing signs of great care.

Every effort has been made to collect the latest and most reliable da concerning ice in the vicinity of the Grand Banks, but very few repo have been made of this great danger south of the parallel of 4 The transatlantic routes, as laid down on the pilot chart, seem to ha been adopted by the Boston steam-ship lines more generally this y than ever before, which accounts, in part, for the scarcity of ice repo Many captains have been inclined to regard the recommendations as necessarily cautious, but such illustrations as the collision of the *Ge* and *Thingvalla* affords have convinced the most skeptical of their v The routes of the various transatlantic steam lines are slowly but sur drawing together, and while, in all probability, they will not reach t extreme limit for ice-season travel recommended by the chart, they w approximate to it, and the adoption of one path each way for all will a great improvement.

The numerous calls for information on all subjects have been met, a the office has had in addition the preparation of sailing directions for river and Gulf of St. Lawrence and the Atlantic coasts of Nova Sc and Bay of Fundy.

New York.—The report from the New York office is full of interes facts in regard to the extensive nature of the work done at that Since the date of issuing the new meteorological forms (only six mon this branch has obtained thirteen hundred good voluntary observ The value of the results deduced from these observations in benefit

commerce by recommending routes for vessels, forecasting the weather, etc., and the probable limits of fogs can not be overestimated.

In December the great Nova Scotia raft broke adrift from the steamship *Miranda* and became a standing menace to navigation. By the advice of this office the Maritime Association of the port of New York requested the honorable Secretaries of the Navy and Treasury to have the danger removed if possible, and subsequently much time was spent in giving information in regard to its latest reported position and its probable course, it being always held that the raft would soon go to pieces.

At the request of the inspector of the third light-house district, inquiries as to the value of bell-buoys were made which resulted in much evidence of their importance.

Up to May 1 only thirty of the reports of ice were received, while there were one hundred and twenty for the same period of last year. This is a repetition of the experience of the Boston office and is due, of course, to the same reasons. As the season advances the force of this branch is much occupied in furnishing information as to the general position and movement of the ice.

The attention called by the United States Hydrographic Office to the use of oil has been most fruitful in its results. The reports of the last few years have been widely circulated, and have caused much interest to be taken in them. The French Steam-ship Compagnie Générale Transatlantique has issued most thorough and interesting instructions to the captains of its vessels for its use whenever occasion offers.

The publication on the Pilot Chart of the average barometer readings of the North Atlantic has been of great assistance to captains, who are constantly acknowledging their indebtedness to this valuable publication.

The sailing directions for the Indian Ocean, recently published by the Hydrographic Office, have been much appreciated. The gnomonic chart of the North Atlantic Ocean is also highly spoken of. The more it is used the more popular it becomes, and hardly a steamer engaged in the North Atlantic trade will be found without one. The number of admiralty cases in which officers attached to the office have been called to testify has very much increased. The subject of barometer comparisons has received careful attention and much useful work has been done in this matter. The recommendation that observers for the Hydrographic Office be furnished with instruments of standard pattern, both barometers and hygrometers, is an excellent one. The class of sea observers is becoming larger and more intelligent and they should have every facility for making good reliable records.

The field of operations of this office is now extensive and goes on increasing. This is apparent from the comparison of the work performed this year with that of last, due, in a measure, to the assumption of the work which the Signal Service previously had done.

Sixty-one hundred and fifteen vessels have been visited, and 3,076 barometers compared. The increased circulation of the Notices to Mariners is interesting, 121,529 copies having been distributed. Regarding this great extension of the work, the insufficiency of the space allotted the office, commented upon in the last annual report, becomes yet more apparent. Efforts have been made to overcome this difficulty but thus far without success. The value of this branch to the sea-faring community can not be too forcibly stated, and it is hoped and believed that means will be given next year to place it on a footing worthy of the dignity of the naval establishment.

Philadelphia.—In this office, as in the others, the work has incre to a considerable extent, owing to the transfer of the collection of teorological data from the Signal Service and the growing apprecia and interest of ship-masters. This is evidenced by their demand fo Hydrographic Office publications, by the number of their observati their increased accuracy, and the promptness with which they are warded. Nearly all the masters of steamers trading from this port many captains of sailing vessels now assist in the work.

A substation will be permanently established at the Delaware Break-water, where much valuable information can be obtained, the occa visits now made to that point being insufficient. The time-ball work well and very few failures are reported.

Here, as elsewhere, the Pilot Chart is much sought after, few ve crossing the Atlantic without it. During the year the information fur-nished to individuals on various subjects of interest to sea-faring people amounted to 12,288 items.

Baltimore.—The new meteorological forms have been issued to vessels, and here, as elsewhere, the old observers of the Signal Service have willingly accepted and agreed to keep records for the Hydro-graphic Office.

The location of the time-ball on the Baltimore and Ohio Railr building is very poor, and its removal to the tower of the observatory in Federal Hill Park is recommended.

Two thousand eight hundred and fifty-four copies of the Pilot Chart, 5,886 supplements, and 30,213 notices were distributed.

New Orleans.—Much has been done to extend and popularize this branch, which is now well known along the entire Gulf coast.

Several institutions of learning in Louisiana, Alabama, and Texas have asked for copies of the Pilot Chart as a means of imparting a prac-tical knowledge of the physical geography of the sea to their students. The new forms have been issued to many vessels, and have been pro-ductive of more uniform and accurate results.

San Francisco.—Time signals are received from the naval observatory at Mare Island daily at noon, and the time-ball managed by this office works well. A standard chronometer enables ship-masters to compare their chronometers, though many rate directly from the time-ball, with-out removing them. Great interest is taken in the tracks of vessels trading to this port, and the subject of the best routes to be followed during various seasons has received much attention.

Sixteen thousand notices to mariners have been distributed, and 2,853 different matters relating to nautical subjects were investigated at the request of individuals.

SUMMARY.

The following is a summary of the work of all the branch offices:

Vessels visited	13,717
Barometers and thermometers adjusted and compared	7,781
Chronometers compared and rated	719
Charts corrected for merchant captains	949
Light lists and buoy books corrected for merchant captains	2,651
Items of information furnished	131,211
Pilot Charts distributed (copies)	32,567
Supplements distributed (copies)	43,719
Beacon and buoy lists distributed (copies)	11,760
Notices to mariners distributed (copies of extracts)	420,171
Reports forwarded on storms at sea, trade-wind limits, fogs, ice, wrecks, water-spouts, buoys adrift, use of oil at sea, electric storms, unknown rocks and shoals, meteorological journals issued, light lists of the United States, pamphlets on the use of oil, and various other subjects of general interest and information on matters connected with navigation, distributed.	24,290

In closing this brief summary of the work of the branch offices, I quote the following from the annual report of the Philadelphia Maritime Exchange:

> BRANCH HYDROGRAPHIC OFFICE.—The workings of this office commend themselves more forcibly than ever to the intelligent consideration of the maritime and commercial public. The amount of information daily disseminated to masters of vessels and others interested in navigation is very considerable, and has helped to demonstrate the fact that the National Government, through its Navy Department, can render to the mercantile marine very efficient service.

LONGITUDE PARTY.

It having been determined by the Bureau that the work of measuring differences of longitude by telegraph should be resumed, steps were taken early by the Hydrographic Office to collect a suitable outfit. In addition to the work carried on by previous parties it was deemed advisable to add observations for magnetic variation, and the latest improved instruments for this purpose were purchased in England. No pains have been spared in the equipment of the party, and it is hoped that this valuable work may be continued without intermission. With the extension of telegraph facilities there is a large increase in the number of points at which observations for longitude are desirable. This ty will complete the work on the west coast of Central America this nter, and next season can be profitably spent in the West Indies and on the Spanish Main.

THE HYDROGRAPHIC OFFICE EXHIBIT.

In obedience to the order to prepare and send an exhibit of this office to the Centennial Exposition of the Ohio Valley and Central States, at Cincinnati, a very complete collection was made.

In the department of chart construction, the whole process of the construction of a chart was shown, first, by a series of ten large photoaphs, 24 by 30 inches, arranged to show the different operations of a hydrographic survey, as undertaken by the officers and men of the United States surveying vessel *Ranger* on the west coast of Lower California. In conjunction with these followed a series of plans, showing the methods of working up the results of these surveys from the first plotting on the rough sheet to the finished, engraved chart. This included the triangulation sheet, the rough, smooth, and reduced plans, the engraved plate (with basso and alto), and the finished chart.

A series of engraved charts followed, showing some of the best work of the office, from original surveys on the west coast of Mexico and Lower California by the *Ranger*. Among those exhibited were the charts of Todos Santos Bay, U. S. S. *Ranger*, Commander Clark; Sacramento Reef, U. S. S. *Ranger*, Commander Cook; Tenacatita Bay, U. S. S. *Ranger*, Commander Philip.

The two latter were printed upon plaster of Paris, which brings out well the fine quality of the work. Copies of the chart of Samaná Bay, from the survey by the *Despatch*, the "Limits under the Fishery Treaties," the "Submarine Cable Map," the "Gnomonic or Great Circle Charts," and the large chart of the "Arctic Regions," from latest authorties, were also included.

Two large models, showing in relief the contour of the bottom of the Caribbean Sea and of the Atlantic Ocean, respectively, were forwarded th the exhibit.

From the meteorological division much of interest was presented,

prominent among which were copies of the Pilot Chart, the Wind and Current Charts of Maury, the Meteorological Charts, and specimens of the journals, forms, etc., to be kept, copies of the supplements of the Pilot Chart, showing the information issued weekly to mariners, specimens of oil-bags, and two oil-exploding rockets for its use at sea.

All the instruments necessary for a hydrographic survey, as well as those used in the telegraphic determination of longitudes, were shown. The latter, in connection with the portable observatory used du several expeditions, was set up at Cincinnati.

INFORMATION.

Reference has been made to the subject of information furnished by this office and its several branches as a part of the routine work performed by each. This embraces questions upon every possible subject of interest to the sea-faring world or connected with the subject of navigation. A glance at the summary of the work of the branch office gives an idea of the extent of these inquiries, and the whole time of the cers on duty there could be taken up with this one matter alone.

In regard to the ice in the vicinity of the Grand Banks, every ef is made to collect the latest and most reliable data, especially at the Boston and New York branches. The captains of transatlantic steamers call on the eve of sailing to obtain the latest information, the daily reports of ice being plotted on each Pilot Chart issued to them.

As a result of this, except in the cases of steamers coming to B via St. Johns, Newfoundland, or Halifax, Nova Scotia, those which cross the fiftieth meridian in a higher latitude than 42° 30′ N. during the ice season are the exception.

In addition to the information furnished by the weekly supplement on the subject of ice the New York office furnishes, at the request of certain steam-ship managers, copies of all ice reports received. The opening of navigation in the St. Lawrence River and Gulf is an important matter to the New York market, and the subsequent movement of the ice in this vicinity is a subject of interest to those chartering vessels for that trade.

On the subject of the West India hurricanes, the articles issued from month to month by the Hydrographic Office have been appreciated, as is apparent by the general adherence of ship-masters to the suggestions published. Following the directions they are often enabled to escape the violence of these storms and to take advantage of the favoring winds. The graphic method of determining the distance from the center and general track by the fall of the barometer at once met with approval.

On October 1 the Hydrographic Office assumed charge of the collection of all ocean meteorological reports, a work which previously had been performed in great part by the Signal Service of the Army. The value of the mass of information now collected is great. The study of ocean meteorology is becoming daily more important to every maritime nation of the world. Not only are we able to benefit commerce by constantly keeping before the public the quickest and safest sea routes, where the best conditions for favorable passages are to be found, but also to forecast with a fair degree of accuracy the probable limits of the North Atlantic fogs.

In December last the steam-ship *Newcastle City* struck on a shoal to the southward and westward of Nantucket New South Shoal light-ship. The captain visited the New York office, and after carefully laying

ı the course and estimating the distance run the fact became obı us that the vessel struck on the $4\frac{1}{2}$ fathom spot shown on Hydro- phic Office chart No. 941. As is usually the case, he was not proııued with a chart of the latest edition.

In order to warn mariners of this dangerous locality the office pub- d, through the New York Herald, a notice calling attention to the that this shoal was shown on Hydrographic Office chart No. 941, ıd that all applicants to the office would be furnished with the requi- e information to avoid it. The invitation was promptly accepted, and many charts were corrected for masters of vessels.

Information as to dangerous wrecks and recommendations as to their removal are constantly being made. Their positions are regularly otted and their location made known. Especially in the case of the ing adrift of the great log raft during the storm of March 11-14 us the value of this information made apparent.

Instances of the services of the branch offices in furnishing informa- on to the maritime world could be multiplied indefinitely. Naturally, from their location, they are brought into immediate contact with the faring community; and the commendatory notices of the press and ritime exchanges show the appreciation in which they are held.

In the New York office alone the number of items of information furnished to individuals reached 91,246, while those furnished by the veral offices make a total of 131,211, an increase of over 30,000 in a y . If we add to this the information and assistance to masters of vessels in the comparison and adjustment of their barometers and ther- meters, in the rating of their chronometers, and in the correction of their sailing charts, light lists, and buoy-books, we have 12,080 more items to be added, making a total of 143,291.

An examination of the "briefing record" of this office shows a con- nt stream of inquiries from the branch offices, foreign hydrographers, ntific societies, the various departments of the Government, masters vessels, and from people everywhere, relating to all branches of nau- al science and practice. In the matter of adjustment of mileage ms the Fourth Auditor refers to the hydrographic office for dis- ces, and much attention has been given to their determination.

These special instances are enumerated to call your attention to an mportant function of the Hydrographic Office, the supplying of informa- ion which must be of considerable value to the whole maritime world.

MISCELLANEOUS.

In pursuance of the policy of doing away with the system of engrav- by contract mentioned in the last two annual reports but very little given out during the past fiscal year.

The sum expended for electrotyping by contract amounted to $2,- .70. In this connection it will be advisable to establish a plant for ctrotyping whenever the room can be obtained. The advantages of have been frequently pointed out. In addition, we have found that depositing copper slowly a plate can be produced sufficiently homo- ous to yield good results when engraved upon, and it is not un- ıy that nearly all the plates used for engraving could be made for mere cost of the copper.

Work on the surveys of the U. S. S. *Ranger* has been continued. The eral harbor-charts referred to in the last annual report having been pleted are now on issue. The demand for these charts keeps pace ıu the increased commercial activity of the Pacific coast.

During the year Commander F. A. Cook, U. S. Navy, c the *Ranger*, has sent in the following rough and smooth sheets: Bay to Sacramento Reef, San Quentin Bay to Lagoon Head, Falsa, Playa, Maria, and Rosalia Bays, Lagoon Head anchorage, bor sheet Todos Santos to Lagoon Head; notes accompanying the sheets of Lower California and records of angles connecting the of triangulation between San Diego and San Quentin, also observations for magnetic declination at Lagoon Head, Rosalia other points on the coast of Lower California, and reports of soun Point San José.

Reports of surveys with accompanying data and other valuable drographic information have been received from the following States naval vessels:

U. S. S. *Yantic*, Commander O. F. Heyerman, survey of Est Harbor, reports and tracings of Aspinwall Harbor, tidal observ of Panama Canal, etc.

U. S. S. *Mohican*, Commander B. F. Day, survey of Fangaloa Upolu Island, Samoa; Te Pito te Henua Island, South Pacific, and report of survey.

U. S. S. *Vandalia*, Capt. H. L. Howison, survey of Pearl entrance, etc., Hawaiian survey of Hilo, reported shoal and tra Sarmiento channel, Patagonia, and other hydrographic informatio

U. S. S. *Palos*, Lieutenant-Commander J. E. Craig, report and t of Ping Yang inlet and Chemulpo.

U. S. S. *Quinnebaug*, Commander W. M. Folger, report upon tracings of proposed harbor improvement Alexandria, Egypt.

U. S. S. *Albatross*, Lieutenant-Commander Z. L. Tanner, repo deep-sea soundings as follows: Norfolk, Va., to Bahia, Brazil; Brazil, to Montevideo, Uruguay; Montevideo, Uruguay, to Pan Colombia; Panama, Colombia, to San Francisco, Cal.

U. S. S. *Essex*, Commander T. F. Jewell, extensive informati cerning the Caroline Islands, Corea, China, and Japan.

U. S. S. *Enterprise*, Commander B. H. McCalla, deep-sea sound North Atlantic, etc.

U. S. Coast Survey steamer *Blake*, Lieut. J. E. Pillsbury, tracin changes made in Port Castries, Station Lucia.

U. S. S. *Pinta*, Lieutenant-Commander J. S. Newell, report upo navigation of Behm Channel, Alaska.

Miscellaneous information of an important character con changes in the visibility of lights, depths of water, reported magnetic observations, etc., was received from the navigators following vessels, and for which thanks are specially due:

U. S. S. *Richmond*, Capt. Robert Boyd.
U. S. S. *Atlanta*, Capt. F. M. Bunce.
U. S. S. *Brooklyn*, Capt. Byron Wilson.
U. S. S. *Trenton*, Capt. N. H. Farquhar.
U. S. S. *Adams*, Commander Louis Kempff.
U. S. S. *Alliance*, Commander Charles McGregor.
U. S. S. *Monocacy*, Commander Henry Glass.
U. S. S. *Adams*, Commander R. P
U. S. S. *Nipsic*, Commander D. W.
U. S. S. *Juniata*, Commander G. I.
U. S. S. *Marion*, Commander N. M. I
U. S. S. *Dolphin*, Commander G. Wilde.
U. S. S. *Palos*, Commander Thom son.

Valuable information has been received from the n of can and foreign vessels, who have also manifested much in careful keeping of the meteorological records furnished them; the secretary of the French Geographical Society this of debted for important data.

GENERAL RECOMMENDATIONS.

Little can be added to the last annual report of the hydrographer in this particular regard. The same necessity for a good building has already been commented upon. No one can do justice to the work in the present cramped, dark, and widely separated quarters. In spite of close attention the most economical and creditable results can not be attained. These and other economical reasons involving the care of the valuable engraved copper plates make it desirable that this office should be properly located as soon as may be.

As it is impossible to rely upon the regular cruisers for hydrographic work several small steamers should be added to the naval establishment to be fitted for this work alone. It will have to be done sooner or later, particularly if the United States ever takes any stand as a maritime power. Charts are no sooner finished than commerce demands better, and it would result in a vast saving of property if surveying vessels should be sent to those localities where trade shows an inclination to spring up and remove all obstruction to its development by sounding out the navigable waters. This office for several years has recommended a survey of the Spanish Main. Enough vessels have been lost on the bar of the Orinoco during the last year to pay for the work several times. The following letter will show the prevailing sentiment on this subject among those most interested:

CONSULATE OF THE UNITED STATES,
Trinidad, British West Indies, March 21, 1888.

SIR: I have to report the loss of the Nova Scotia bark *Annapolis* on the bar at the mouth of the Orinoco River, on the 15th instant, and that the American bark *Kennard*, of Boston, narrowly escaped from shipwreck at the same place and date by the jettison of a portion of her cargo. The cargo consisted of iron ore taken from the mine at Imiataca on the Orinoco River. There are two other barks loading there, and it is feared that they will be lost in crossing the bar. It is unfortunate that the vessels should have met with misfortune, as there will be trouble hereafter to effect insurance. The *Kennard* sailed from here for New York to-day, after having undergone a survey. The captain tells me that the bar has not been surveyed, the charts incorrect, and there are no buoys to guide the navigator. The banks of the Orinoco are rich with mines, and if the bar at the mouth of the river were properly surveyed there would no doubt spring up a larger trade between our States and the Orinoco.

I am, sir, your obedient servant,

MOSES H. SAWYER,
Consul.

The necessity for a deep-sea survey of the Pacific becomes more apparent with the increase of commerce, and two steamers, of the right type, could now be profitably employed there. If it is not advisable to build, the proper vessels might be hired.

The question of a steamer to take care of the wrecks along the coast will probably be decided by the International Marine Conference to be held in Washington next April. This is the direct outcome of the efforts of this office, commenced several years ago, as a reference to the hydrographer's reports will indicate.

A special appropriation should be asked for a series of charts of the coasts of China and the East. We are not progressing with sufficient rapidity in the matter of becoming independent of foreign nations in regard to nautical publications. It will be some years yet before the present resources of the office will allow it to leave the charting of the coasts of America, and there is a demand for charts of all parts of the world. The same reasons hold with regard to the series of the coast of Europe commenced some years ago and for which a sum is asked for in the estimates of this office submitted for the next fiscal year.

In conclusion, I wish to call to your favorable attention the officers in charge of the several divisions—Lieutenants Fremont, Laird, Coff Ensign Whittelsey, and Mr. Everett Hayden. The accomplishment of the duties incident to administrative work of this character has been rendered possible by their willing and capable support. The same is true in regard to those in charge of the branch offices—Lieutenants Conway, Downes, McIntosh, Cottman, Stoney, and Parker, and Ensign Wall. Their efficient care for and appreciation of the interests intrusted to them have been one of the largest factors in the success of the Hydrographic Office as a whole.

While all the civilian employés deserve commendation, there are several who by intelligent application to their work render services of especial value. These are Messrs. G. W. Littlehales, G. Herrle, W. M. Whiting, Boynton Leach, T. S. O'Leary, A. H. Dutton, R. L. Lerch, R. H. Orr, and J. S. Stodder, the chief clerk.

Thanks are due for valuable information and assistance to the Department of State, the Coast and Geodetic Survey, the Light-House Board, Geological Survey, Smithsonian Institution, Fish Commission, the Bureau of Navigation of the Treasury Department, the Government Printing Office, and to all foreign hydrographic offices and marine boards. The maritime bodies and the press of the coast have uniformly seconded the efforts of the Hydrographic Office in every possible way.

Very respectfully,

GEORGE L. DYER,
Lieutenant U. S. Navy,
Hydrographer to Bureau of Navigation.

Commodore J. G. WALKER, U. S. Navy,
Chief of Bureau of Navigation.

DIVISION OF CHART CONSTRUCTION,
Hydrographic Office, July 1, 1888.

SIR: I have the honor to submit the following report for the fiscal year ending June 30, 1888, which embodies statements, principally in the form of statistical tables, of the progress made in the work of construction and publication of nautical charts, of the present condition of the work which is being done, and of the distribution of force; and accounts of the investigations into the subject of geographical longitudes and the variation of the compass, which have been made with a view to improving the accuracy and consistency of nautical publications, and of the adaptation of certain machines to the purposes of chart engraving whereby the capacity of the force is increased and greater economy and uniformity attained.

There is also proposed for your special consideration an outline of the work which could be most profitably performed during the next fiscal year.

Charts completed and published during the fiscal year ending June 30, 1888.

General locality.	Catalogue number.	Title.	Scale.	Size.	When begun.	When published.
West Indies	1005	Trinidad Island	D. lat. = 24.3	30 by 42	Sept., 1885	July, 1887
Central America, West Coast	1028	Parida and Palenque Anchorages	M. = 1.0	19 by 24	Oct., 1886	July, 1887
Mexico, West Coast	1044	Soledad Bay and Santo Tomas Anchorage	M. = 2.0	12 by 15	Apr., 1887	July, 1887
Mexico, East Coast	1048	Coatzazoacos River	M. = 1.0	12 by 15	Mar., 1887	July, 1887
		Plan of mouth of river	M. = 4.0			
Mexico, West Coast	1031	Potrero and Braxilito Bays	M. = 2.0	16 by 19	Jan., 1887	July, 1887
Santo Domingo	1014	Caldera Bay	M. = 4.0	14 by 18	Apr., 1886	Aug., 1887
Costa Rica, West Coast	1017	Judas Point to Burica Point	D. lat. = 15.0	27 by 32	Aug., 1886	Aug., 1887
United States of Colombia	1019	Morro Puercos to Cocalita Point	D. lat. = 15.0	28 by 37	Apr., 1886	Aug., 1887
Do	1042	Panama Road	M. = 2.0	23 by 29	Jan., 1887	Aug., 1887
Lower California	1045	Colnett Bay	M. = 2.0	12 by 15	Apr., 1887	Aug., 1887
Bahama Islands	1050	Cockburn Harbor	M. = 6.0	9 by 12	Mar., 1887	Aug., 1887
North America	980	Great Banks of Newfoundland, etc	D. long. = 4.5	30 by 40	May, 1885	Sept., 1887
Do	981	Cape St. Mary's to Halifax	D. long. = 4.5	29 by 45	June, 1885	Sept., 1887
Central America, West Coast	1016	San Juan del Sur to Judas Point	D. lat. = 15.0	27 by 32	June, 1886	Sept., 1887
Do	1041	Coiba or Quibo Islands	M. = 1.0	25 by 30	Nov., 1886	Sept., 1887
Caribbean Sea	1049	Santa Anna Harbor	M. = 6.0	18 by 15	Mar., 1887	Sept., 1887
New Brunswick	1051	Port St. Andrews	M. = 4.0	13 by 16	June, 1887	Sept., 1887
West Indies	1069	Martinique	M. = 1.0	30 by 36	Feb., 1886	Oct., 1887
Central America, East Coast	1052	Belize Harbor	M. = 1.0	20 by 24	May, 1887	Oct., 1887
Newfoundland	1053	Miquelon Road	M. = 2.0	12 by 15	Apr., 1887	Oct., 1887
Central America, West Coast	1037	Gulf of Dulce	M. = 1.0	32 by 26	Jan., 1887	Nov., 1887
Bay of Fundy	1057	Grand Manan Island	M. = 1.0	26 by 31	Mar., 1887	Nov., 1887
Newfoundland	1055	Miquelon Islands	M. = 1.0	25 by 31	Apr., 1887	Dec., 1887
New Brunswick	1074	L'Etang Harbor	M = 3.0	22 by 26	June, 1888	Dec., 1887
West Indies	1059	Port du Moulo	M = 22.0	12 by 18	Aug., 1887	Dec., 1887
Do	1010	Barbados	M = 1.0	26 by 31	Dec., 1885	Dec., 1887
		Plan of Carlisle Bay	M = 4.0			
South Atlantic Ocean	1071	South Atlantic Ocean	D. long. = 0.45	40 by 37	Feb., 1887	Jan., 1888
West Indies	1065	Port Louis, Guadeloupe	M = 5.0	13 by 10	Sept., 1887	Jan., 1888
Do	1058	Christiansted Harbor, Santa Cruz	M = 5.0	13 by 16	July, 1887	Jan., 1888
Mexico	1046	Todos Santos Bay	M = 1.5	20 by 22	July, 1887	Jan., 1888
Venezuela	1062	Coche Island Anchorage	M = 2.0	14 by 17½	Aug., 1887	Jan., 1888
Newfoundland	1056	St. Pierre Harbor, Miquelon Islands	M = 4.0	19 by 23	April, 1887	Feb., 1888
Lower California	1043	San Quentin Bay	M = 1.0	21 by 21	July, 1887	Feb., 1888
		Plan of entrance to San Quentin Bay	M = 4.0			
West Indies	1082	Galet Anchorage	M = 6.0	10½ by 13½	Nov., 1887	Feb., 1888
South America	968	Orinoco River to Maraca Island	D. long. = 4.5	30 by 51	July, 1885	Mar., 1888
United States of Colombia	1018	Burica Point to Morro Puercos	D. lat. = 15.0	26 by 41	Sept., 1886	Mar., 1888
Central America, West Coast	1060	Punta Arenas Anchorage	M = 3.0	17 by 22	Aug., 1887	Mar., 1888
Cape Breton Island	1061	Sydney Harbor	M = 2.0	19 by 22½	July, 1887	Mar., 1888
Nova Scotia	1069	Beaver Harbor	M = 2.0	16½ by 22	Aug., 1887	Mar., 1888

Charts completed and published during the fiscal year ending June 30, 1888—Continued.

General locality.	Catalogue number.	Title.	Scale.	Size.	When begun.	When published.
North Atlantic Ocean	1070	North Atlantic Ocean	D. long = 0.45	38 by 37	Nov., 1886	Mar., 1888
West Indies	1083	Port Sainte Marie	M = 6.0	10½ by 13½	Nov., 1887	Mar., 1888
Lower California	1084	Lagoon Head Anchorage	M = 4.0	9½ by 11	Feb., 1888	Mar., 1888
Do	1085	Rosario Bay and Sacramento Reef	M = 1.0	16½ by 20	Nov., 1887	Mar., 1888
West Indies	1063	Basse-Terre Roads	M = 6.0	17½ by 25	Aug., 1887	Apr., 1888
Gulf of St. Lawrence	1066	Prince Edward Island	D. lat. = 15.0	24 by 39	Mar., 1887	Apr., 1888
West Indies	1073	St. François Anchorage	M = 18.0	12½ by 15½	Sept., 1887	Apr., 1888
Nova Scotia	1074	Canso Harbor	M = 4.0	20½ by 25½	June, 1887	Apr., 1888
Gulf of St. Lawrence	1076	Picton Harbor	M = 3.0	19½ by 25½	Sept., 1887	Apr., 1888
United States of Colombia	1068	Aspinwall	M = 4.0	21 by 26	Oct., 1885	May, 1888
Islands of Martinique	1064	La Trinite Bay	M = 4.0	13 by 16½	Nov., 1887	May, 1888
Gulf of St. Lawrence	1079	Port Hood	M = 4.0	19½ by 25½	Oct., 1887	May, 1888
West Indies	1086	Sainte Anne Anchorage	M = 18.0	14 by 18	Jan., 1888	May, 1888
Central America, East Coast	1072	Chinchorro Bank	M = 1.0	24 by 31	July, 1887	June, 1888
Canada	1067	Bay of Chaleurs	D. lat. = 15	28 by 39	Jan., 1888	June, 1888
Prince Edward Island	1077	Cardigan Bay	M = 2	17.4 by 22	Dec., 1887	June, 1888
Venezuela	1087	Estanques Bay	M = 6	11 by 13	May, 1888	June, 1888
Newfoundland	1088	Harbor Breton	M = 4	9.7 by 13	Apr., 1887	June, 1888
Do	1089	Lamalin Harbor	M = 4	15 by 18.5	Dec., 1887	June, 1888
Prince Edward Island	1080	Bedeque Harbor	M = 3	18 by 22.6	Oct., 1887	June, 1888
Nova Scotia	1075	Guysborough Harbor	M = 4	17.6 by 21.5	Nov., 1887	June, 1888
Newfoundland	1090	Gaultois and Picarre Harbors	M = 4	9.7 by 13	Apr., 1888	June, 1888
Do	1091	Cow Head Harbor	M = 4	16 by 19.8	Feb., 1888	June, 1888
Gulf of St. Lawrence	1092	Magdalen Islands	D. lat. = 15	20 by 24	Nov., 1887	June, 1888

NOTE.—The scale of the chart is expressed by D. long., the length of a degree of longitude on the equator; by D. lat., the length of a degree of the meridian in the middle latitude of the chart; and by M., the length of a nautical mile. The size of the chart is expressed in inches, measuring between the extreme edges of the border. All the charts mentioned above are engraved on copper plates.

ELECTROTYPING AND PRINTING.

:ing the year there were received 20 electrotype altos and 5 bassos; ık plates were purchased, and 25 were made by scouring down olishing condemned plates; 18 engraved plates were withdrawn ase. The number of copper and steel chart plates available for ng is 441; from these were printed 19,807 copies of charts for issue 51 proofs. There are also 100 miscellaneous engraved plates from were printed 1,852 copies. The comparison of this year's printing ;hat of preceding years is as follows:

	Copies.
3	12,180
	16,910
ɔ	21,025
6	18,640
7	20,413
	21,659

dition the force of printers was employed in miscellaneous print- ıu stamping as follows:

letter paper	reams..	24$\frac{1}{10}$
note paper	do....	5$\frac{5}{8}$
envelopes	do....	5,096

Summary.

	Total to June 30, 1887.	Finished during the year.	Condemned during the year.	Total to June 30, 1887.
d chart plates	393	63	15	441
neous plates	98	2		100
engraved chart plates	108	20		128
f engraved chart plates	69	5	3	71
ions of engraved plates for issue				21,659
f engraved plates for office use				551

:ing the year 495 B. A. charts, which were replaced by later edi- on the shelves of the archives, were placed in the repository es- hed in this division for the reception of condemned charts.

The distribution of force.

Engaged.	Draughtsmen.	Record clerk.	Copyist.	Engravers.	Apprentice engravers.	Printers.	Apprentice printer.	Laborers.
ıtant to the chief of the division, in the re- of engraving, and in compiling and com- ;and directing the computations of results data in relation to terrestrial magnetism ographical positions	1							
ving and charging information which may H. O. charts, and in preparing for engrav- current corrections on published charts	1							
ring the sounding sheets of the Atlantic, , and Pacific Oceans, and in compiling a of deep-sea soundings	1							
ring new charts for engraving, and in cor- such charts as require extensive correc-	7							
ıter	1							
d clerk		1						
ist			1					
ving new charts, and in engraving cor- ıs and additions on charts on issue				15	3			
g charts for issue, in printing and stamp- al letter-heads, in stamping official cards elopes, and in backing charts						3	1	
ing and cleaning condemned plates for re- ing								3
nger								1
tal	11	1	1	15	3	3	1	4

THE RECORD OF LONGITUDES.

This work has been carried on with reference to those parts of world not embraced by the United States and Europe, where surveys a high degree of accuracy have been executed whose results are widely published as to need no further attention. Its principal field among the less accurately known parts of the world, about which information, although of great importance, is not current. The extent of the investigations into this subject has reached a magnitude which enables the work to bear intimately upon the hydrographic operations of the office, and it has tended to induce accuracy and uniform practice and to prevent reduplication of work.

The number of secondary meridians outside of the United States and Europe, established by telegraphic measurement, is sixty. The longitudes of a considerable number of places have been related to them with such a degree of care as to render them also secondary meridians of a rank nearly equal in point of accuracy with those telegraphically determined. There are thus nearly one hundred accurately established secondary meridians to which chronometric measurements have been related to the number of about thirty-five hundred. There are also number of absolute determinations regarded as worthy of confidence. Efforts have been made to establish among the different longit that consistency which the number of observations now accum gives us a right to expect, and to exhibit both the elements that entered into their composition and the use that the compiler has of his evidence.

This work ought ultimately to form an important contribution to the perfection of hydrographic knowledge.

The complete condition and value of this work is due to Mr. G. W. Littlehales, C. E., under whose charge it has been from the start.

MAGNETIC VARIATIONS.

The collection and discussion of data for the investigation of magi variation has been continued by Mr. G. W. Littlehales, C. E.

The work of the Hydrographic Office in this subject, as in that geographical positions, is confined to those parts of the world not included in the United States and Europe.

There are now two hundred and twenty-six shore stations at which by research in numerous books, there have been collected six hund and ninety observations ranging in date from the beginning of the seventeenth century to the present time.

From all series of observations which are sufficiently extensive, empirical equations have been deduced by which values are predicted and annual rates of change found.

According to the plan mentioned in the last annual report 1,863 reliable observations at sea have been collected and compiled. Those falling within the area of the North Atlantic Ocean were used in connection with the predicted values at the shore-stations on its borders to deduce the general equation to the lines of equal variation over the whole of this area. The results of this work appear on the new chart of the North Atlantic Ocean, published in March, 1888.

The lines of equal variation on the new chart of the South Atlantic Ocean are the results of the application of an approved graphical process to observations of a late date entered on the chart itself.

These observations were made principally by United States naval officers while serving as navigators of vessels of war, and they have been published in Naval Professional Papers, No. 19, "The Variation of the Compass."

THE ADAPTATION OF TRANSFERRING TO COPPER-PLATE ENGRAVING.

After the manner of transferring in bank-note making, all those features which are the same on every chart, such as the seal, the marginal lettering, and the rims of degree compasses, are now transferred to the copper-plates in a small fraction of the time taken to engrave them from hardened steel-rolls bearing them in alto. The practical success of this operation is largely due to the mechanical skill of Mr. V. L. Ourdan, engraver.

BORDER PLANING MACHINE.

During the year Messrs. Ourdan and Kolb, engravers, designed and reduced to practice a machine for planing out the borders on chart-plates which obviates the necessity for tedious hand-work in this respect.

GNOMONIC CHARTS.

The engraving of the projection on the plate for the gnomonic chart of the Indian Ocean having been finished in the early part of the fiscal year, this plate was used to reproduce, by electrotyping, plates for the North and South Pacific Oceans. Mr. Gustave Herrle, chief draftsman, to whom the work of constructing this series of charts has been intrusted, has prepared the drawing for the chart of the North Pacific for the engraver, and has that for the Indian Ocean well advanced. It is expected that this series of sailing charts will be completed during the next year.

DEEP-SEA SOUNDINGS.

The work of collecting the reliable deep-sea soundings which have been observed in the Indian Ocean has been outlined on six sheets on a scale of 1½ inches to the degree of longitude. The sounding work in the Caribbean Sea has been plotted, and a sheet covering the area of the Gulf of Mexico is in course of preparation. The sounding sheets of the Atlantic and Pacific Oceans have been brought practically up to date.

U. S. S. RANGER'S WORK.

All the harbor charts resulting from the survey of the U. S. S. *Ranger* on the west coast have been completed and are on issue. As soon as this season's work is received it will be taken up at once for publication.

OUTLINE OF WORK FOR NEXT FISCAL YEAR.

All the more important coast and harbor charts in the region of Newfoundland and the Gulf of St. Lawrence have been engraved or are ready for engraving.

In order to complete the series, it is proposed to work upon the following harbor charts, which are not yet begun, and gradually to re-

place the photolithographed charts of this region which are being issued by the office as the editions now on hand become exhausted:

General locality.	Title.	Remarks.
Quebec	Belles Amour Harbor	The H. O. has no chart of this place.
Do	Bonne Esperance Harbor	Do
Do	Mistanoque Harbor	Do.
Do	Little Mecattina Island	Do.
Do	Hare Harbor	Do.
Do	Netagamu River	Do.
Do	Watagheistic Sound	Do.
Do	Waipatagun Harbor	Do.
Do	Coacoacho Bay	Do.
Do	Kegashka Bay	Do.
Do	Little Natashquan	Do.
Do	Mingan islands	Do.
Do	Seven Islands Bay	Do.
Do	Manitou River	Do.
Do	Cawee islands	Do.
Do	Mount Louis Bay	Do.
Do	Magdalen River	Do.
Do	Gaspé Bay and Harbor	Do.
Do	Mal Bay	Do.
Do	Paspebiac Bay	Do.
Do	Dalhousie Harbor	Do.
Do	Heron Island	Do.
Do	Caraquette Harbor	Do.
Do	Shippegan Harbor	Do.
New Brunswick	Miscou Harbor	Do.
Do	Miramichi Bay	Do.
Do	Richibucto River	Do.
Do	Buctouche River	Do.
Do	Cocagne Harbor	Do.
Do	Caribou Harbor	Do.
Nova Scotia	Antigonish Harbor	Do.
Cape Breton Island	Mabou Harbor	Do.
	Great Bras d'Or Lake	Do.
Quebec	Quebec Harbor	Do.
Nova Scotia	Madame Island and Lennox Passage, with southern entrance to Gut of Canso.	Would replace B. A. chart 2756.
	Gut of Canso	Would replace B. A. chart 2342.
Magdalen Islands	Amherst Harbor	Would replace B. A. chart 1143.
Do	Grand Entry Harbor	Would replace B. A. chart 1144.
New Brunswick	Approaches to Passamaquoddy Bay.	The H. O. has no chart of this place.

The following charts in the West Indies, on the east and west coasts of South America, are proposed for publication in order to enable the office to issue complete sets in these regions.

General locality.	Title.	Remarks.
Cuba	Puerto Frances	Photolithograph edition exhausted.
Jamaica	Monte Christo to Fort Dauphin Bay.	Do.
Do	Fort Dauphin Bay	Do.
Bahama Islands	Acklin's Island anchorage	Do.
Do	Pelican and Little Harbors	Do.
Do	Man-of-War Cay	Do.
St. Lucia	Vieux Fort Bay	The H. O. has no chart of this place.
Caribbean Sea	Island of Margarita and vicinity.	Photolithograph edition exhausted.
Do	Island of Oruba	Do.
Do	Islands of Curaçao and Buen Ayre.	Do.
Central America	Port Livingston	Commercially important. Data not yet available.
East coast South America.	Ceara Bay	The H. O. has no chart of this place.
Do	San Alexio Island	Do.
Do	Buenos Ayres Road	Do.
Do	Bahia Blanca to Union Bay	Commercially important.
Do	Flores Island (Rio de la Plata.)	
Guiana	Maroni and Mana Rivers	Would replace H. O. 439, which is worthless.
	Surinam River	

General locality.	Title.	Remarks.
West coast South America.	Port Huasco	Would replace B. A. chart No. 575.
	Port Papudo, Horcon and Quintero Bays.	Would replace B. A. chart No. 1300.
Do	Maytencillo cove; Pichidanque Bay; Algarrobo road.	Would replace B. A. chart No. 1307.
Do	Port Copiapo; Pajonal cove; Chaneral de las Animas; bay.	Would replace B. A. chart No. 1315.
Do	Port Caldera and Yngles; Lavata bay; Pan de Azucar anchorage; Port Flamenco.	Would replace B. A. chart No. 1302.
Do	Cobija bay; Algodon bay	Would replace B. A. chart No. 1301.
Do	Arica road	Would replace B. A. chart No. 578.
Do	Islay bay and Artico road	Would replace B. A. chart No. 1340.
Do	Port Chilca	Would replace B. A. chart No. 1710.
Do	Huacho bay; Chancay bay	Would replace B. A. chart No. 1347.
Do	Salango Island anchorage; Caracas river; Santa Elena bay.	Would replace B. A. chart No. 2799.
Central America	Panama canal and railroad	Would replace B. A. chart No. 657.

The charts of the Hawaiian Islands and their ports are from old surveys and are very inaccurate. It is proposed gradually to republish these from the data resulting from the Hawaiian Government survey, and from the recent surveys by United States vessels.

It is also the object to connect and harmonize the work already done in detached portions on the coasts of China and Japan, the ultimate object being, as far as general and special coast charts are concerned, to compile a series of charts of such scales as have already been found best adapted for similar charts in other parts of the world, and which shall be cheaper, more accurate, and of better limits than the existing ones.

With this object in view it is proposed during the coming year to publish plans of the more important harbors on the coasts of China and Japan.

Miscellaneous plates completed during the year.

Title.	Remarks.
Index chart for Sailing Directions for the Caribbean Sea and Gulf of Mexico, Vol. I.	Engraved on copper.
Standard conventional hydrographical and topographical signs and symbols.	Engraved on copper. To secure uniformity amongst all engravers in Hydrographic Office.
Plate comprising the standard border lettering; and the circumferences, and degree figures and divisions of the standard compasses.	Engraved on steel to be taken up on steel transfer rolls.

The following numbered chart-plates have been corrected to the dates shown below:

No. of chart.	Date.	No. of chart.	Date.	No. of chart.	Date.	No. of chart.	Date.
643	July, 1887	23	Jan. 1888	364	Mch. 1888	6	May
127	Aug. 1887	27	Jan. 1888	377a	Mch. 1888	15	May
132	Aug. 1887	29	Jan. 1888	527	Mch. 1888	30	May
307	Aug. 1887	54	Jan. 1888	609	Mch. 1888	147	May
363	Aug. 1887	114	Jan. 1888	611	Mch. 1888	276	May
982	Aug. 1887	217	Jan. 1888	661b	Mch. 1888	281	May
118	Sept. 1887	619	Jan. 1888	705	Mch. 1888	282	May
131	Sept. 1887	620	Jan. 1888	916	Mch. 1888	283	May
143	Sept. 1887	621	Jan. 1888	917	Mch. 1888	371a	May
185	Sept. 1887	879	Jan. 1888	923	Mch. 1888	372	May
188	Sept. 1887	903	Jan. 1888	941	Mch. 1888	610	May
192	Sept. 1887	904	Jan. 1888	942	Mch. 1888	720	May
218	Sept. 1887	931	Jan. 1888	943	Mch. 1888	825	May
219	Sept. 1887	932	Jan. 1888	947	Mch. 1888	944	May
220	Sept. 1887	933	Jan. 1888	956	Mch. 1888	946	May
266	Sept. 1887	949	Jan. 1888	981	Mch. 1888	972	May
809	Sept. 1887	1015	Jan. 1888	994	Mch. 1888	991	May
969	Sept. 1887	1016	Jan. 1888	995	Mch. 1888	1001	May
970	Sept. 1887	1027	Jan. 1888	1032	Mch. 1888	1009	May
971	Sept. 1887	1028	Jan. 1888	1033	Mch. 1888	1010	May
1038	Sept. 1887	1029	Jan. 1888	21a	Apr. 1888	1047	May
1045	Sept. 1887	1034	Jan. 1888	26a	Apr. 1888	22a	June
1006	Oct. 1887	35	Feb. 1888	31	Apr. 1888	32	June
1007	Oct. 1887	160	Feb. 1888	36	Apr. 1888	67	June
1036	Oct. 1887	161	Feb. 1888	70	Apr. 1888	77	June
260	Nov. 1887	519a	Feb. 1888	157	Apr. 1888	84	June
518b	Nov. 1887	704	Feb. 1888	158	Apr. 1888	89	June
264	Nov. 1887	826b	Feb. 1888	349	Apr. 1888	91	June
876	Nov. 1887	914	Feb. 1888	389	Apr. 1888	96	June
518a	Nov. 1887	915	Feb. 1888	520a	Apr. 1888	112	June
965	Nov. 1887	925	Feb. 1888	520c	Apr. 1888	133	June
978	Nov. 1887	937	Feb. 1888	528	Apr. 1888	149	June
38	Dec. 1887	967	Feb. 1888	581b	Apr. 1888	270	June
85	Dec. 1887	973	Feb. 1888	724	Apr. 1888	394	June
87	Dec. 1887	1025	Feb. 1888	824a	Apr. 1888	524	June
95	Dec. 1887	1042	Feb. 1888	874	Apr. 1888	529	June
119	Dec. 1887	12	Mch. 1888	945	Apr. 1888	549b	June
124	Dec. 1887	21	Mch. 1888	1017	Apr. 1888	849	June
125	Dec. 1887	22	Mch. 1888	1030	Apr. 1888	924	June
318	Dec. 1887	37	Mch. 1888	1035	Apr. 1888	930	June
964	Dec. 1887	40	Mch. 1888	1043	Apr. 1888	1005	June
1019	Dec. 1887	45	Mch. 1888	1044	Apr. 1888	1018	June
1026	Dec. 1887	159	Mch. 1888	1046	Apr. 1888		
3	Jan. 1888	348	Mch. 1888				

New charts in course of construction, unfinished at the close of the fiscal year.

General locality.	No.	Preliminary title.	Scale.	Size.	When begun.	Remarks.
South Atlantic	23	South Atlantic, Sheet I	D. long. = 5/10	29½ by 30	Dec., 1879	These plates have been laid aside, as the need for them is not great and other work is more important.
Do	23a	do	D. long. = 5/10	25 by 29½	Dec., 1879	
Do	24	South Atlantic, Sheet II	D. long. = 5/10	25 by 29	Dec., 1879	
Do	24a	do	D. long. = 5/10	29½ by 30	Dec., 1879	
West Indies	1094	Island of Antigua	M. = 1½	29½ by 37	Sept., 1885	In hands of lettering engraver.
Canada	1013	Gulf of St. Lawrence	D. long. 4½	32½ by 28	May, 1885	Will be published in Sept., 1888.
East Indies	5p	Batavia to Singapore	D. long. 2.7	34½ by 24½	Oct., 1885	Ready for lettering engraver.
Lower California	11p	San Diego to San Quentin				Not yet begun.
Newfoundland	24p	Southeast Newfoundland	D. lat. 15	25 by 42¼	May, 1887	Ready for lettering engraver.
Do	25p	Southwest Newfoundland	D. lat. =15	26⅝ by 39¼	June, 1887	Ready for typographic engraver.
Do	26p	Northwest Newfoundland	D. lat. =15	27 by 38¼	June, 1887	Ready for lettering engraver.
Prince Edward Island	1068	Hillsborough Bay and Charlotte Harbor	M. = 2	26½ by 34½	July, 1887	Will be published in August, 1888.
Newfoundland	34p	South coast of Newfoundland	D. lat. =15	25¾ by 40	Aug., 1887	In hands of lettering engraver.
Central America	41p	Gulf of Honduras	M. = ¼	21¼ by 28¼	Aug., 1887	In hands of draughtsman.
Newfoundland	1078	Twillingate Harbor	M. = 4	19¾ by 24½	Sept., 1887	In hands of lettering engraver.
New Brunswick	1081	Shediac Harbor	M. = 3	19¼ by 23¾	Oct., 1887	Do.
Canada	52p	River St. Lawrence, Quebec, to mouth of Saguenay	D. lat. =15	21¼ by 27	Nov., 1887	Ready for engraving.
Gulf of Mexico	55p	Straits of Florida to mouths of Mississippi	D. long. = 4½	32⅝ by 39⅞	Nov., 1887	Ready for lettering engraver.
Chile	56p	Valparaiso Harbor	M. = 4	21¼ by 26¼	Nov., 1887	Ready for engraving.
East Indies	58p	Sunda Straits	D. lat. =15	28¼ by 41¾	Nov., 1887	Do.
Newfoundland	59p	Northeast Newfoundland	D. lat. =15	24 by 39½	Dec., 1887	Do.
Nova Scotia	60p	Country Harbor	M. = 2	20¾ by 26	Dec., 1887	Do.
Canada	63p	Coast of Quebec, Cape Mackinnon to Little Natashquan Harbor.	D. lat. =15	28¼ by 36½	Jan., 1888	Do.
East Indies	64p	Singapore and Rhio Straits	M. = ⅓	27¾ by 36½	Jan., 1888	Do.
Nova Scotia	65p	White Haven Harbor	M. = 4	24½ by 28¼	Jan., 1888	Do.
Cape Breton Island	66p	Scatari Island and Menadou Bay	M. = 2	15½ by 20½	Jan., 1888	Ready for lettering engraver.
Canada	68p	Coast of Quebec, Little Natashquan Harbor to Magpie Bay.	D. lat. =15	28¾ by 34	Feb., 1888	Ready for engraving.
Nova Scotia	70p	Liverpool Bay and Port Mouton	M. = 1½	20.7 by 22.5	Feb., 1888	Do.
Cape Breton Island	71p	St. Anne Bay and Great Bras d'Or	M. = 2	26 by 32	Mar., 1888	Do.
Newfoundland	72p	St. John's Harbor	M. = 9	19¾ by 25¾	Mar., 1888	Do.
Canada	73p	River St. Lawrence, Pointe de Monts to Anticosti Island	D. lat. =15	24 by 34	Mar., 1888	Do.
Nova Scotia	74p	Merigomish Harbor	M. = 3	15½ by 17½	Mar., 1888	In hands of topographic engraver.
Do	75p	Tatamagouche Harbor	M. = 2	18¾ by 23½	Apr., 1888	Ready for engraving.
Do	76p	Pugwash Harbor	M. = 3	19 by [illegible]	Apr., 1888	In hands of lettering engraver.
Newfoundland	78p	Great Tervis Harbor	M. = 4	9½ by 13½	Apr., 1888	Do.
Nova Scotia	79p	Sheet Harbor	M. = 2	20 by 25½	Apr., 1888	Ready for engraving.
Guiana	82p	Approaches to Demerara and Essequibo rivers	M. = ½	25½ by 36½	May, 1888	Do.
Hawaiian Islands	83p	Hilo Bay	M. = 4	15 by 18½	May, 1888	In hands of topographic engraver.
Nova Scotia	84p	Ship Harbor	M. = 2	20½ by 25½	May, 1888	Ready for engraving.
Canada	85p	River St. Lawrence, Saguenay River to Pointe de Monts	D. lat. =15	22½ by 29	May, 1888	Do.
Prince Edward Island	86p	Crapaud Road	M. = 3	11½ by 15¼	June, 1888	Do.
Do	87p	Wallace Harbor	M. = 3	15½ by 21	June, 1888	In hands of draughtsman.

New charts in course of construction, unfinished at the close of the fiscal year—Continued.

General locality.	No.	Preliminary title.	Scale.	Size.	When begun.	Remarks.
Gulf of Mexico	88*p*	Mouths of Mississippi to mouth of Rio Grande	D. long. = $4\frac{1}{2}$	32 by 43	June, 1888	In hands of draughtsman.
Guiana	89*p*	Mouths of Demerara and Essequibo rivers	M. = $1\frac{1}{2}$	28 by 39	June, 18·8	Do.
Nova Scotia	90*p*	Nicomtau Bay	M. = 2	$16\frac{1}{2}$ by $21\frac{1}{2}$	June, 1888	Do.
Do	94*p*	Fangaloa Bay	M. = 6	$14\frac{1}{2}$ by $20\frac{3}{4}$	June, 1888	Ready for engraving.
Hawaiian Islands	91*p*	Ewa or Pearl River and locks	M. = 5	26 by 31	June, 1888	In hands of draughtsman.
North Pacific Ocean	998*p*	Gnomonic chart of North Pacific Ocean		25 by 38	1888	Ready for engraving.
South Pacific Ocean	997*p*	Gnomonic chart of South Pacific Ocean		25 by 28	1888	In hands of draughtsman.
Indian Ocean	996*p*	Gnomonic chart of Indian Ocean		25 by 38	1887	Ready for engraving.

Very respectfully,

CHARLES LAIRD,
Lieutenant, U. S. Navy.

Lieut. G. L. DYER,
U. S. Navy, Hydrographer.

DIVISION OF SUPPLY, HYDROGRAPHIC OFFICE,
July 1, 1888.

SIR: I have the honor to make the following report for the fiscal year ending June 30, 1888:

It is the duty of this division to keep on hand a supply of all Hydrographic Office and Coast Survey charts published, and to keep them corrected to date. The addition of another draftsman has added very much to the efficiency of the division in correcting charts, and now this work is up to date.

There are 435 plate and 301 photolithograph charts on hand, making a total of 736 Hydrographic Office charts; the Coast Survey charts are ordered in quantities as required to meet the demand for supplying United States vessels only.

The number of copies of charts issued during the fiscal year just ended exceeds the number issued during the preceding year by 2,794; the number sold is greater by 832 copies than it was for the preceding year.

The photolithograph charts are gradually being done away with, as new engraved charts are made covering the same localities. The photolithographs in the West Indies have been carefully overhauled and the variation was found to be nearly one-third of a point wrong; this has been corrected so as to agree with the latest information in possession of the office.

All Hydrographic Office charts have been constantly compared with the new foreign charts received, and the difference noted, in order that all discrepancies might be investigated and errors corrected. Therefore when a copy of a chart is issued from the office it is correct as far as known. During the past year all Hydrographic Office charts have been carefully compared and made to agree with the corrected light-list.

A large number of corrections having accumulated on index chart C, covering the West Indies, and as the supply on hand is almost exhausted, I would suggest that a new index chart, covering this locality, be published at as early a date as possible, also that a special plan, on a larger scale, covering the Island of Cuba be made upon this same index.

Much time and work has been devoted to looking up and answering questions referred to this division, with regard to various naval and scientific information, and, in order to facilitate this work, I would suggest that a journal of such information be kept for future reference.

The branch offices and United States vessels have been regularly supplied with copies of all new and corrected charts. The chart catalogue for 1888 was prepared in this division.

The following summary shows the number of charts published, issued, and canceled:

Statement of charts for fiscal year ending June 30, 1888.

	Third quarter, 1887.		Fourth quarter, 1887.		First quarter, 1888.		Second quarter, 1888.		Total.
	H.O.C.	C.S.C.	H.O.C.	C.S.C.	H.O.C.	C.S.C.	H.O.C.	C.S.C.	
Copies of charts received—									
From printing-room	3,482	....	2,686	....	5,474	....	5,868	....	17,510
From Coast Survey	....	678	....	916	....	1,661	....	1,334	4,589
Total	....	....	....	....	....	....	....	....	22,099
Copies of charts issued—									
To naval vessels	538	330	812	395	2,012	688	800	663	6,238
To archives	30	9	78	16	41	22	62	55	313
To agents	1,823	....	2,173	....	1,891	....	2,147	....	8,034
To merchant vessels	186	....	91	....	59	....	54	....	390
To merchants, meteorological charts	120	....	120	....	84	....	36	....	360
To foreign hydrographers	196	....	28	....	56	....	84	....	364
To home correspondents	216	....	120	....	126	....	234	....	696
Miscellaneous	1,875	379	1,219	394	1,847	486	1,030	507	7,737
Total	4,979	718	4,641	805	6,116	1,196	4,447	1,225	24,127
Charts published	17	....	10	....	16	....	20	....	63
Copies of charts condemned	57	24	5	53	57	16	47	42	301
Charts canceled	9	....	3	....	8	....	11	....	31
Plans canceled	....	....	1	....	3	....	1	....	5
Copies of canceled charts condemned	581	....	106	....	449	....	989	....	2,125

Very respectfully,

DE WITT COFFMAN,
Lieutenant, U. S. Navy.

Lieut. G. L. DYER,
U. S. Navy, Hydrographer.

DIVISION OF ISSUE,
Hydrographic Office, July 1, 1888.

SIR: I have the honor to submit the following report for the year ending June 30, 1888:

During the year the following vessels have been furnished with a full allowance of charts, as per standard catalogues of stations, viz: *Enterprise* and *Lancaster*, fitted out for the European station; *Nipsic*, *Albatross*, *Trenton*, *Dolphin*, and *Swatara*, fitted out for the Pacific station. The *Swatara* returned her Pacific station charts and was then fitted out for the South Atlantic station; *Pensacola*, fitted out for the North Atlantic station. Partial outfits have also been furnished to the following vessels: *Boston*, *Chicago*, *Pensacola*, *Michigan*, *Constellation*, and the monitor *Terror*.

The Senate Committee on Foreign Relations was furnished with two sets of charts covering the Atlantic coast from the boundary of Maine northward.

Besides these outfits the Branch Hydrographic Offices, Coast Survey, and Division of Chart Construction are continually requiring British

Admiralty charts for reference, and all such charts, when out of the office for any length of time, require from five minutes to half an hour's comparison before they can be restored to the shelves. This, together with the corrections required by the Notices to Mariners and comparison of charts received, both from England, France, and the Imray Publishing Company, keep the two draftsmen fully employed.

The complete record of charts on board every naval vessel in commission and the receipts and expenditures of charts in the office, together with the correction of station catalogues, furnish abundant work for one book-keeper.

A new catalogue of the North Atlantic station has been made out, also a new ledger, the form of which greatly facilitates the work of showing a true record of charts.

The following summary shows the number of charts received, issued, and condemned during the year:

Received:	
From J. D. Potter, agent for admiralty charts, London, England	4,121
From British Admiralty (complimentary)	209
From United States vessels	655
From branch hydrographic offices	160
From division of chart construction	97
From archives	26
Index charts taken into account	92
From B. F. Stevens, United States dispatch agent, London, England	1,748
From division of supply (Hydrographic Office and Coast Survey charts)	5,006
Total	12,114
Issued:	
To United States vessels, from this office, British admiralty	3,824
To United States vessels, from this office, Hydrographic Office	3,298
To United States vessels, from this office, Coast Survey	1,708
To United States vessels, through B. F. Stevens	1,748
To division of chart construction	173
To archives	423
To branch hydrographic offices	159
To Senate Committee	82
To Coast Survey	20
Miscellaneous	29
Total	11,464
Condemned	1,638
Total number of charts on hand	10 435

The 53 Notices to Mariners published during the year affected 1,265 standard admiralty charts, and required hand corrections on 2,286 copies.

There were 2,320 admiralty charts corrected by hand from British admiralty data and no date alterations.

Total number of charts corrected by hand, 4,606.

There have been 35 new admiralty charts published and put on issue.

Respectfully submitted.

W. B. WHITTELSEY,
Ensign, U. S. Navy.

Lieut. GEO. L. DYER, U. S. Navy.
Hydrographer

DIVISION OF SAILING DIRECTIONS,
Hydrographic Office, July 1, 1888.

SIR: I have the honor to submit the report of this division for the fiscal year ending June 30, 1888.

The divisions of books, archives and mailing have been consolidated and placed under the one division entitled division of sailing directions. The restoring and cataloguing, made necessary by the meteorological division taking part of the space allotted to the division of books, has been completed.

In continuation of the plan of issuing a complete set of sailing directions, edited by the Hydrographic Office, the following books have been issued: West Coast of Mexico, No. 84, and Indian Ocean, No. 85. Three others are either in the hands of the Public Printer or are ready for printing.

The following vessels have been fitted out with professional libraries during the year: *Albatross, Nipsic, Enterprise, Swatara, Omaha, Pensacola, Dolphin, Constellation, Lancaster and Trenton.*

The following books have been placed in the division for issue: Bowditch Navigator, ed. of 1887 and 1888; Catalogue of charts, plans, and sailing directions, 1888; Report of Hydrographer for 1887; Coast of Mexico and Central America, H. O. No. 84; Indian Ocean, including Java Sea, Sulu Sea, Afuera Sea and Philippine Islands, H. O. 85; Supplement Atlantic Coast Pilot, subdiv. B. C. 8; Australian Directory Vol. II, B. A. (Supplement); Baltic Sea and Gulf of Finland, B. A. (Supplement); Black Sea Pilot, B. A. (Supplement); California and Oregon Coast Pilot, C. S. (Supplement); China Sea Directory, Vol. II, B. A. (Supplement); China Sea Directory, Vol. III, B. A. (Supplement); West Coast of England, B. A. (Supplement); West Coast of Hindostan, B. A. (Supplement); Mediterranean Pilot. Part IV, B. A. (Supplement); Pacific-North Reported Dangers, H. O. (Supplement); Pacific-South-Reported Dangers, H. O. (Supplement); St. Lawrence Pilot, Part II, B. A. (Supplement); North Sea Pilot, Part I, B. A. 1887; North Sea Pilot, Part IV, B. A. 1887; Gulf of Aden Pilot, B. A.; Bay of Bengal Pilot, Imray.

In the subdivision of notices there were published during the year 9[illegible] announcements of importance to navigation.

The number of copies of books on hand for issue July 1, 1887 was	36,7[illegible]
Number of books received during fiscal year	8,4[illegible]
Total	45,2[illegible]
Number issued during fiscal year	6,9[illegible]
Remaining on hand July 1, 1888	38,315

Exchanges with foreign countries, as well as other means of collecting information, have been greatly extended.

The light lists, consisting of six volumes, have been revised and are corrected to date, ready for publication at any time. Eleven hundred and forty documents have been indexed and 2,495 charts have been catalogued during the year in the section of archives.

In view of the fact that many of the sailing directions are very faulty and require supplements to bring their information up to date I would recommend that the force of this division be increased sufficiently to proceed rapidly with the work of completing the issue of a set of sailing directions which will embody the latest information.

Very respectfully,

J. C. FREMONT, JR.,
Lieutenant, U. S. Navy.

Lieut. G. L. DYER, U. S. Navy.
Hydrographer.

DIVISION OF MARINE METEOROLOGY,
Hydrographic Office, July 1, 1888.

SIR: In reporting upon the work of this division during the past fiscal year I would first of all refer to the scope and general character of the work which would seem properly to belong to it; its present organization and the character and amount of work actually accomplished, and, finally, the changes in organization and facilities for carrying on its work that seem of greatest importance.

The field of work properly belonging to this division is very wide, and a variety of circumstances combine to make it of great importance to the naval service, the commercial marine, and the people generally. Unless the United States is to abandon this field entirely and take all its knowledge of the wide range of phenomena of both scientific and practical utility comprised by the term "marine meteorology" at second hand, by means of reprints or translations of the publications of foreign offices and authorities, this division of the Hydrographic Office should have far greater facilities for utilizing the vast amount of data already at hand and constantly increasing. It is a field in which there is no competition, and from the nature of things there can be none. No private individual, firm, or corporation is in a position to collect the data necessary for a comprehensive study of the subject, nor are their interests such as to make the undertaking an object, even were it possible to do so. And yet there are so many questions of great practical interest and importance that can only be answered by means of a continuous, well-directed, and intelligent prosecution of the work, on a broad and comprehensive basis, that every consideration of propriety and policy would seem to recommend it. Marine meteorology includes the meteorology of the high seas; the weather, winds, and currents of the various oceans of the globe; the changes that take place in them during each month of the year; and the practical deductions to be drawn from such knowledge, as a guide to navigation. To be able to draw such conclusions with any accuracy requires a thorough knowledge of the progress that has been made already in the field through the labors of our own and foreign governments; a familiarity with the conditions and requirements of navigators; the collection and proper co-ordination of new facts bearing upon the subject, and a careful comparison and co-ordination of such new facts with the data already at hand. In this way modern scientific progress in various directions may be brought to bear upon the practical conduct of maritime affairs, and thus become a factor of great economic importance, by shortening ocean voyages, reducing the hazards to life and property, and lessening the rates of marine insurance upon vessels and cargo.

Although the available force and facilities have hardly been more than enough to carry on the routine work of the division, the publication of the Monthly Pilot Chart and Weekly Supplement, and the proper handling of forms and journals used in the collection of data for these publications, yet their acknowledged value to commerce can not but be regarded as proving the importance of still further extending the work to include every ocean to which American commerce reaches, or to which it is likely to reach in the immediate future. As you are well aware, however, the number of assistants, the amount of room, and the want of a good library of standard works of reference, make it almost impossible at present to extend the work of the division. Advantage has been taken, however, of every possible opportunity to widen the field of action. Special attention has been devoted to the Pilot Chart.

and its high standard of efficiency, usefulness, and reliability have been constantly and favorably commented upon both at home and abroad, and certain changes that have been made in it, as well as in the Weekly Supplement, have added materially to the value of each. In the matter of wreckage data, one of the special and most important features of these publications, I would express my hearty appreciation and approval of the thorough and efficient assistance of Mr. T. S. O'Leary, whose special technical training has made his work most reliable and valuable. It has required the most unremitting care and accuracy; reports that are conflicting must be compared and the evidence carefully considered; wrecks near the coast must be accurately located and any change in their location or condition noted; opportunities watched for that a government vessel may be detailed to remove the most dangerous obstructions, and no source of additional information allowed to escape attention. Similarly, Mr. R. L. Lerch has carried on a thorough revision of the graphic meteorological data published on the Pilot Chart as a forecast of the weather for the month immediately following the date of issue, by means of an exhaustive comparison of the meteorological charts issued by this office and the data derived from a great system of international meteorological observations inaugurated and conducted by the U. S. Signal Service. In addition thereto his extensive knowledge and familiarity with the principal modern languages have made his assistance of the greatest value. Mr. A. H. Dutton has had entire charge of the records relating to the issue and return of meteorological journals and various forms for recording reports of marine meteorology. All journals and reports have been carefully scrutinized as soon as received, questions contained therein answered, and suitable comment made upon points of special interest, thus keeping alive that feeling of co-operation and sympathy between our observers and this office so essential to a satisfactory conduct of the work. Moreover, Mr. Dutton has personally plotted and studied all meteorological data for the North Atlantic, and has each month written the Weather Review published on the Pilot Chart, a work in itself requiring special scientific knowledge and aptitude. In addition to the Weekly Supplement, advantage has been taken of every opportunity to issue a monthly supplement whenever some subject of special interest has seemed to demand it. In September, for instance, a supplement was issued descriptive of West India Hurricanes and the Law of Storms; with the December chart a discussion of the Best Transatlantic Routes, and the Winter Storm Belt of the North Atlantic; and with the March chart a description of Waterspouts off the Atlantic Coast of the United States during January and February. All of these have been in great demand, and are often called for even now by masters of vessels. In addition to these, each of which has involved a large amount of extra work, considering that the force is hardly large enough to handle the current work of the division, I prepared and delivered a lecture before the Franklin Institute, Philadelphia, on the Pilot Chart, and it was published in full in its journal; data regarding the last summer's hurricanes have been collected from all available sources and only await an opportunity for publication; and a monograph on the great storm off the Atlantic coast of the United States, March 11–14, with six descriptive plates, is in readiness for the printer.

Amongst the most important improvements that have been inaugurated is the preparation and issue in large quantities of sets of forms upon which to record reports of marine meteorology. These contain, in clear and compact form, columns for recording various kinds of data, each

sheet containing space for a month's record, a year's supply being bound together in a pamphlet, with one page devoted to an explanation of the system itself and the symbols used in making the record. As soon as a vessel reaches port, one sheet is torn out and forwarded to the nearest hydrographic office; in a foreign port it is handed to a United States consul, who forwards it with his official mail. This system has worked admirably and has greatly facilitated work both aboard ship and in this office.

Results of the greatest value have been obtained by means of the system of co-operation with the U. S. Signal Service, by which meteorological data are exchanged and utilized by both offices, without any duplication of work in their collection. The adoption of such a simple and rational system can not but be regarded as a most important step in advance, and one that should be carried on with the greatest earnestness and sincerity, to mutual benefit both as regards the work itself and a proper economy of administration. Reports of marine meteorology are now received regularly each month from 46 Government vessels and 541 of the mercantile marine, and fully 30 vessels a month are added to the list of those sending in reports to this office. Although a majority of them navigate the North Atlantic, yet reports are received from vessels in every ocean, and it only needs a suitable incentive and the means to utilize the data in order to build up a system of marine meteorological observation second to that of no other government. During the year there have been received also 176 meteorological journals and 110 new ones have been issued, although no special effort has been made to do so, because, as stated in my last annual report, there were already on hand more than 1,500 of these journals, containing valuable data regarding the navigable waters of the globe, but at present useless and inaccessible to the maritime community on account of the lack of means to properly collate and publish the results.

The future work of the division, as it might be planned with a proper regard to the material already at hand, the facilities for collecting reliable and valuable data by means of the branch hydrographic offices established in our principal ports, and the importance of the prosecution of marine meteorological research, is thus clearly indicated by the brief outline of what is now being done with a small force and very limited facilities. Nor have I thus far touched upon the desirability and importance of issuing standard meteorological instruments to masters of vessels who take observations for this office, as this was enlarged upon in my last report and need only be referred to now. The building up of an efficient, well organized, and valuable division of this office upon the foundation now established only awaits, it seems to me, proper encouragement and support, and I trust that the next annual report of the chief of this division may record its successful accomplishment.

Before closing I would take advantage of this opportunity to refer briefly to the valuable assistance rendered by Ensign Ernest Wilkinson, U. S. N., who was attached to this division for several months, but, finally, to my regret, ordered to other duty.

Respectfully submitted.

EVERETT HAYDEN,
Ensign, U. S. Navy (Retired.)

Lieut. G. L. DYER, U. S. Navy.
Hydrographer.

and its high standard of efficiency, usefulness, and reliability have been constantly and favorably commented upon both at home and abroad, and certain changes that have been made in it, as well as in the Weekly Supplement, have added materially to the value of each. In the matter of wreckage data, one of the special and most important features of these publications, I would express my hearty appreciation and approval of the thorough and efficient assistance of Mr. T. S. O'Leary, whose special technical training has made his work most reliable and valuable. This has required the most unremitting care and accuracy; reports that are conflicting must be compared and the evidence carefully considered; wrecks near the coast must be accurately located and any change in their location or condition noted; opportunities watched for that a government vessel may be detailed to remove the most dangerous obstructions, and no source of additional information allowed to escape attention. Similarly, Mr. R. L. Lerch has carried on a thorough revision of the graphic meteorological data published on the Pilot Chart as a forecast of the weather for the month immediately following the date of issue, by means of an exhaustive comparison of the meteorological charts issued by this office and the data derived from a great system of international meteorological observations inaugurated and conducted by the U. S. Signal Service. In addition thereto his extensive knowledge and familiarity with the principal modern languages have made his assistance of the greatest value. Mr. A. H. Dutton has had entire charge of the records relating to the issue and return of meteorological journals and various forms for recording reports of marine meteorology. All journals and reports have been carefully scrutinized as soon as received, questions contained therein answered, and suitable comment made upon points of special interest, thus keeping alive that feeling of co-operation and sympathy between our observers and this office so essential to the satisfactory conduct of the work. Moreover, Mr. Dutton has personally plotted and studied all meteorological data for the North Atlantic, and has each month written the Weather Review published on the Pilot Chart, a work in itself requiring special scientific knowledge and aptitude. In addition to the Weekly Supplement, advantage has been taken of every opportunity to issue a monthly supplement whenever a subject of special interest has seemed to demand it. In September, for instance, a supplement was issued descriptive of West India Hurricanes and the Law of Storms; with the December chart a discussion of the Best Transatlantic Routes, and the Winter Storm Belt of the North Atlantic; and with the March chart a description of Waterspouts off the Atlantic Coast of the United States during January and February. All of these have been in great demand, and are often called for even now by masters of vessels. In addition to these, each of which has involved a large amount of extra work, considering that the force is hardly large enough to handle the current work of the division, I prepared and delivered a lecture before the Franklin Institute, Philadelphia, on the Pilot Chart, and it was published in full in its journal; data regarding the last summer's hurricanes have been collected from all available sources and only await an opportunity for publication; and a monograph on the great storm off the Atlantic coast of the United States, March 11–14, with six descriptive plates, is in readiness for the printer.

Amongst the most important improvements that have been inaugurated is the preparation and issue in large quantities of sets of forms upon which to record reports of marine meteorology. These contain, in clear and compact form, columns for recording various kinds of data, each

sheet containing space for a month's record, a year's supply being bound together in a pamphlet, with one page devoted to an explanation of the system itself and the symbols used in making the record. As soon as a vessel reaches port, one sheet is torn out and forwarded to the nearest hydrographic office; in a foreign port it is handed to a United States consul, who forwards it with his official mail. This system has worked admirably and has greatly facilitated work both aboard ship and in this office.

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Respectfully submitted.

EVERETT HAYDEN,
Ensign, U. S. Navy (Retired.)

Lieut. G. L. DYER, U. S. Navy.
Hydrographer.

U. S. BRANCH HYDROGRAPHIC OFFICE,
Custom-House, Boston, Mass., July 9, 1888.

SIR: I have the honor to submit the following report of the work of the Boston branch of the Hydrographic Office for the fiscal year ending June 30, 1888:

It has been my constant study to improve the standing of the office among the shipping people of Boston, and to extend its benefits to the other New England sea-port towns. This has been decidedly difficult work. Owing to the limited force employed I have been confined almost constantly to the office, and have been occupied continually with the regular routine, leaving but limited opportunities to attend to outside matters, and even necessitating the discontinuance of correction of charts and light and buoy lists, in order that more necessary work might go on without interruption. The time has come when more room and a larger force are imperatively necessary, owing to the vast increase of the field of this branch during the past year.

As to the former, there should be two rooms, or one large room with a portion partitioned off as a private office for the officer in charge, who should be so situated as regards the working force as to be always at liberty to receive visitors calling for the purpose of special consultation, as well as to absent himself as occasion may render it expedient, without interfering with the routine work.

The personnel should consist of an officer, a lieutenant in charge, and one junior officer to superintend the work of the office, to attend to the wants of the ordinary visitor, to see to the mailing of charts, supplements, etc., and, in fact, to be responsible, under the lieutenant in charge, for the proper conduct of the indoor operations of the office. He should have one assistant, a bright, intelligent boy, to care for the office, and during office hours to be available for the many calls which are sure to be made on him. In addition to the above there should be an assistant in charge of the work of ship-visiting, to be responsible for the proper prosecution of this branch of the work; associated with him should be a second assistant, an intelligent boy, for whom there would be constant employment in visiting the less important of the arrivals, of which there are always more than can possibly be attended to by one person. A bright boy could very soon master the details of the barometer and become proficient in making intelligible and reliable abstracts from vessels' logs. For this latter work I would most earnestly urge the adoption of the plan proposed by Lieutenant Cottman in his report for the year ending June 30, 1887, that graduates of the apprentice system be employed. They have an education and training which makes them eminently fit for this kind of work. Boys whose homes are in the vicinity of the offices in which they are employed could be selected for this purpose, or they could be attached to the receiving-ship where such exist and are available. A small monthly sum, in addition to their regular pay, would undoubtedly prove a great inducement, and I believe it would be easy to find candidates for the positions.

To carry out this plan at present would necessitate the hiring of an office, as it is useless to expect more extended quarters in the custom-house, where the space is already inadequate to the needs of the service, until the building is enlarged, which it is hoped will be done in the near future.

It is needless to say that the place for the Boston branch is in the custom-house, and but for the fact that the work of the office is fast outgrowing its capacity, I would not think of suggesting a change.

the end of another year if there is no prospect of getting more space in this building a move will be absolutely necessary.

The lack of office room should not interfere, however, with the increase of force suggested above, which is absolutely essential to the proper prosecution of the work under any circumstances. The expense attending the increase of force would be small if the plan proposed be carried out, and would be hardly worth considering when taken in connection with the advantage to the office and the addition to its usefulness.

In connection with ship-visiting, the use of a small steam-launch for two or three hours daily, as has already been suggested in previous reports, would be advantageous. The necessity for such an improvement in our facilities is becoming more and more apparent with the gradual extension of the water-front of the city, rendering the work of the ship-visitor more and more arduous. It is already impossible for him to keep pace with the arrivals, but with the assistance of a boy and a launch we shall do very well for some time to come.

It might be pertinent to state in this connection that I have been obliged to keep my assistant in the office almost continually for the past two weeks or more, in order to be at liberty to prepare the yearly report; consequently the work of visiting has been, of necessity, somewhat neglected.

At least twice each year it would be well if the officers in charge of the various branches could be ordered to visit the principal sea-ports of their respective districts, in order to extend the knowledge of the offices, and the benefits they confer on the sea-faring community, and, at the same time, to increase the opportunities for collecting useful information.

In connection with this the officers in charge of the Atlantic coast branch offices might be instructed to meet at some convenient point, preferably New York, to discuss the operations of the offices and to secure uniformity in methods.

If such a thing be possible, the improvement in the Pilot Chart has increased its popularity among sea-faring men, and with landsmen as well, as the steady increase in the demand amply proves. I hear nothing but words of commendation and praise for the publication and the office publishing it. I have taken advantage of every opportunity to consult with captains regarding its usefulness, and in no case during the past six months or more have any of them had any suggestions to make for its further improvement. In obedience to your instructions an effort was made early in the year to introduce it more generally among the public schools of the New England States, and letters were written to several of the superintendents of schools on the subject. There was little success at first, and, owing to the pressure of other work, I was unable to follow the matter up as I should like to have done, consequently the showing of the office in this particular is not quite so favorable as it might have been. We have a number of school addresses on the list, however, and, after the present rush of business I hope to add to them considerably.

The supplement to the Pilot Chart has proved valuable to the vessels in the coasting trade as well as to those bound on more distant voyages, and the expressions of approval of them are coming to us continually.

The printing of the notices to mariners in extract form was a long step in the right direction. Experience shows that the plan originally adopted, of dividing the earth into certain areas, now requires some mod-

ification. The following division into districts is proposed as being more suitable and convenient:

1. Greenland, Arctic coasts of North American, Labrador, and the British Provinces of North America, excepting the southeast coast of Nova Scotia and the Bay of Fundy.
2. Southeast coast of Nova Scotia and Bay of Fundy, Atlantic coast of the U. States, and the Bahama Islands.
3. West Indies, Gulf of Mexico, Caribbean Sea, and north coast of South America to Brazil.
4. East coast of South America from French Guiana to Cape Horn, with adjacent islands.
5. Islands in the Atlantic Ocean.
6. Atlantic coast of Europe to Cape St. Vincent, British Isles, English Channel, North and Baltic Seas, with connecting waters, adjacent islands, and Iceland.
7. Mediterranean, Red, and Black Seas, the western limits to be Cape St. Vincent on the north and Spartel on the south.
8. West coast of Africa.
9. East coast of Africa, Indian Ocean, and islands as far as and including the Bay of Bengal.
10. East Indies, Australia, east coast of Asia, Japan, and all adjacent islands.
11. Islands in the Pacific Ocean.
12. West coast of North America with adjacent islands.
13. West coast of South America with adjacent islands.

The publication of the waterspout supplement has had considerable effect in calling the attention of mariners to the subject of waterspouts and has aroused them to the importance of making more careful observations of these phenomena. Several very complete and extremely useful records have been received in this office, and every effort is made to induce masters of vessels and other observers to use the utmost care in filling out the blank reports which are issued with the supplements.

The light and buoy lists of the coasts of the United States continue very popular with the masters of vessels, particularly those in the coasting trade. In connection with this subject I make would one or two suggestions. When packages of these books are being forwarded by the Light-House Board to the branch offices, the contents of each package should be clearly indicated on the outside. This can be done easily and without trouble when the packages are first made up, and it will be of the greatest possible benefit and assistance to us, as we are obliged to open every package, under the present arrangement, in order to ascertain its contents, while we can make use of but one package at a time for distribution in our limited quarters.

When changes in aids to navigation are made, necessitating corrections in the light or buoy lists, it would be useful if these corrections were printed in a form to correspond with the columns of the books. A large number of each of these corrections, printed on sheets so as to be readily detached, could be inserted in the proper place in the book to which it refers. It has been impossible during the past year to keep the lists corrected up to date, owing to the growth of our work and the lack of working force, consequently they are in a degree unreliable when issued. With some such arrangement as that proposed it would be possible to keep them absolutely correct.

I would take advantage of this occasion to again urge the great importance of an arrangement or understanding with the Light-House Board by which the branch hydrographic offices may be immediately notified of any change or proposed change in the aids to navigation on our coast. The failure to notify us has been the cause of much embarrassment to this office in the past. Applications for information of this character are always referred to the light-house inspector of the district interested, but it would be a great convenience to have it to give

at the same time with other current information which can be obtained only at the branch offices. The new charts of the North and South Atlantic Oceans have been favorably received by navigators, sometimes with the criticism that the scale is rather small for general use, and the absence of all soundings is undesirable. If the charts are to be continued on issue, I would suggest that a certain amount of soundings be given in the vicinity of the land. As regards the true compass used on these and other Hydrographic Office charts, the weight of opinion among the old sea-captains is still against it. I never neglect an opportunity to make its advantages clear, and, so far as the young masters are concerned, seldom fail of success, but it is hard, indeed almost impossible, to move an old sea-captain out of his groove. The change from the old style of magnetic compass was a good one and should be adhered to. The reason for objecting to the change given by many of the fault-finders, that two changes instead of one are necessary, is decidedly weak, for there is not one master in a thousand who can not, in a second of time, combine the two corrections into one in his head. To my mind it is almost entirely a matter of prejudice.

The Hydrographic Office is to be congratulated on the rapidity and excellence of its work in the publication of the new charts being issued of late. They are highly appreciated by the sea-faring community, and it is to be hoped that Congress will continue to encourage the good work by means of liberal appropriations until we shall have become entirely independent of the chart-publishing offices of foreign countries.

It is to be regretted that the masters of many of the foreign steam lines are obliged by law to make use of their own charts and other publications, as, to my certain knowledge, many of them would make use of the Hydrographic Office charts in preference were they permitted to do so. Special efforts should be made in preparing new charts; that for Sunda Straits should be on issue at the earliest possible moment. Good charts of the Rio de la Plata and tributaries are also in demand, and should be published as early as practicable.

The "Fishery Limits" charts issued by the Hydrographic Office have proved to be most acceptable to the fishermen, and have undoubtedly served to keep more than a few of them out of trouble.

The index and price-lists recently issued have been distributed as generally as possible; that is, to those who would be at all likely to require and make use of them. Much could be accomplished in this direction which is at present impossible if the officer in charge of this branch could occasionally take a trip along the coast, visiting the principal sea-ports, as suggested in the first part of this report.

Every effort has been made to obtain as complete and accurate a record of wind, weather, and barometer data as possible from the logs of incoming vessels. It has been utterly impossible, with the force at my disposal, to do anything more than copy these records with all possible detail and forward them to Washington. The work of collecting data has been much simplified by the issue of the new Hydrographic Office forms (form 105) for recording Greenwich noon observations. So far as Boston is concerned, I am convinced that the transfer of this work from the Signal Service to our office was a good move and for the best interests of all concerned, although it has added very decidedly to our labors.

With a few exceptions none of these books have been issued from this office to masters of vessels without full explanation of their purposes and of the method of keeping the record. When forwarding to vessels in other ports than Boston I have taken considerable pains to write

letters of explanation, believing that a few records kept understandingly are more valuable than a large number of imperfect ones.

The returns have been fairly good; many of the records show signs of great care, and evince a perfect understanding of their object and the method of keeping. On the other hand, in spite of all the taken, many records are received which are of no value whatever, so far as their real object is concerned; in such cases attention is called in the letters of acknowledgment from this office to the errors and the need of being as accurate as possible in every detail. In this way it is hoped that in future the value of the records turned in may be very greatly increased. In this connection I would suggest the printing of a complete sample sheet of record for issue with the form to such as do not seem to have a very clear idea of the method of keeping or to whom we have no opportunity to explain, and also a cloud sheet, similar to that contained in the meteorological journals, for such as are not familiar with the forms and names of the clouds. These two could easily be combined on one sheet of paper, and would undoubtedly be of great assistance to observers.

From reports made at this office by masters of vessels who have forwarded the records from foreign ports, it would seem that some of consuls do not entirely understand that they are to receive and forward them, and the sender has been obliged, in such cases, either to hold them until arrival in a United States port, or forward at his own expense. These complaints have come invariably from the masters of foreign vessels.

Every effort has been made by this office to collect the latest most reliable data concerning ice in the vicinity of the Grand Banks. Being an off year for ice, however, the reports of this great danger to navigation south of the parallel of 45° N. have been few. The recommendations with regard to transatlantic routes, as set forth on the Pilot Chart, seem to have been adopted, so far as the Boston steam-ship lines are concerned, more generally this year than ever before, which may in part account for the scarcity of ice reports.

Except in the cases of steamers coming to Boston via St. John's, Newfoundland, or Halifax, Nova Scotia, it has been the exception for them to cross the fiftieth meridian during the ice season in a higher latitude than 42° 30′ N., whereas in previous years the exceptions to this rule have been considerably in excess of those of the year just closed.

In the past, many captains have been inclined to consider the recommendations made as being unnecessarily cautious; but it is an undoubted fact that the number of this class is decreasing rapidly. The wisdom of the recommendations made can not be doubted by any reasonable man.

The routes followed by the various transatlantic steam lines are slowly but surely drawing together, and the result will be the final general adoption of one route for all outward-bound, and another for inward-bound vessels.

In all probability while these routes will not reach the extreme limit for ice-season travel recommended on the chart, they will approximate to it, and the adoption of one path for all will be a great improvement over the go-as-you-please policy followed by some of the companies in the past.

The subject of the use of oil in calming dangerous seas is receiving more and more attention from sea-faring men as time goes on, and the testimony to its efficacy, gathered by this office, has been of the most satisfactory nature. The Hydrographic Office is certainly to be con-

gratulated on the success which has attended its efforts in this particular, for the use of oil has undoubtedly saved many a vessel from destruction, or at least from serious disaster. There are instances of captains, well known here, who utterly disbelieved in the efficacy of oil, and were induced, against their own judgment, to try the experiment by the accounts set forth on the Pilot Chart and by the representations made in this office. At the present time these same captains are the most earnest and confirmed believers in the practice, and never go to sea without a complete outfit of oil and appliances for its use.

Besides the regular routine work, this office has had continual calls on its time and attention for information which have often necessitated going far outside its legitimate field of work. But no request for information is ever denied until every possible means of obtaining it has been exhaused.

During the past year this office has had in preparation a Sailing Directions for the River and Gulf of Saint Lawrence and the Atlantic coasts of Nova Scotia and Bay of Fundy. The work has been pushed to the limit of our ability, and I hoped at one time to finish it before the end of the year just closed, but the detachment of my assistant, Lieutenant Gove, U. S. Navy, rendered this impossible; indeed, since he left, the work has of sheer necessity been almost entirely neglected. Every effort will be made to complete it in the near future.

In concluding this report I would state that from all the Treasury Department officials and employés in the custom-house, from the various firms and members of the shipping community of Boston, from the press, and, indeed, from all with whom the office is brought in contact, we have received constant and unvarying kindness and encouragement, and our labors have in consequence been made doubly easy and pleasant. Most earnest thanks are due to all who, by word or deed, have shown their appreciation of the labors of the Hydrographic Office in behalf of the merchant marine of the world.

The following table shows in detail and aggregate the work accomplished by this branch during the year just closed:

	1887.						1888.						
	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Vessels visited	239	208	277	251	346	273	246	256	189	204	248	74	2,811
Barometers compared or adjusted	6	109	215	180	216	190	143	182	150	134	168	75	1,778
Thermometers compared	..	..	....	....	....	..	..	...	....	...	1	...	3
Information furnished to individuals	1,657	1,04[illegible]	1,391	1,114	1,400	1,129	1,186	1,043	1,275	1,190	1,705	1,310	14,861
Meteorological journals:													
Vessels taking journals		1	2	2	4	1	....	1	....	1	1	2	17
Vessels turning in journals (filled or partially so)	2	2	....	2	1	2	....	....	....	1	1	....	10
Journals issued to vessels	1	4	10	5	11	2	...	4	....	2	1	6	48
Journals turned in (filled or partially so)		3	...	2	2	5	.	....	....	3	3	...	19
Records of Greenwich noon observations (Form 105):													
Vessels taking the "forms"	..	....	....	....	......	...	67	16	18	68	58	54	281
Vessels turning in "forms" (filled out)	....	....	....	....	....	....	....	19	36	37	53	63	208

	1887.						1888.						
	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Charts issued, corrected, etc.:													
General sailing charts furnished vessels	14	19	27	12	20							2[illegible]	
Meteorological charts furnished vessels					44								
Sailing charts corrected for masters of vessels	19	2	1	8	8	7	15	5	2	2			
Corrections on office charts (notices to mariners)	95	43	81	138	98	107	116	170	169	149			
Pilot charts distributed	700	668	748	684	710	732	620	700	635	710	846	730	[illegible]
Pilot chart supplements distributed	500	510	684	570	861	769	890	698	981	1,066	1,353	1,244	[illegible]
Index charts and price-lists distributed													
Fishery limits charts distributed													
Telegraph charts of the world distributed													
Miscellaneous publications:													
Light lists of the United States distributed	75	64	12	32	108	77	55	62	8	150	148	129	
Buoy books of the United States distributed	268	266	392	516	570	404	430	310	382	474	310	293	[illegible]
Hydrographic Office, notice to mariners distributed	6,773	6,227	9,047	10,165	10,505	8,641	8,667	6,666	7,372	9,642	9,629	8,129	[illegible]
Pamphlets distributed:													
Use of oil at sea	20	43	53	41	60	39					2	56	
West-India hurricanes	16	40	37	37	34	38						17	
Sound signals													
Rules of the road	8	34			31	13	45	36	10	9	25	95	
Annual report of Hydrographer for 1886-'87										15			
Reports forwarded to Washington:													
Storms	21	25	54	33	47	42	48	45	50	40	32	11	
Trade-wind limits	59	52	51	49	34	20	40	39	37	55	60	29	
Wrecks and wreckage	18	12	27	30	41	35	43	36	30	45	43	23	
Buoys adrift	7				1	3	2	2	1	3	3	2	
Water-spouts	3	4	1	1	3	1		1	1	1	2	10	
Fogs	35	42	23	10	9	12	3	15	14	15	48	41	
Ice	5	2		1				1	2	1	10	8	
Whales	4				2	2	1	1	2	2	7	10	
Letters on the use of oil at sea	3	2	3	1	1	3	4	4	7	4	3	1	
General information received and forwarded				1			2						
Electric storms		1	1	1	2			1	3	6	14	1	
Meteors			4		2	1		1				1	
Unusual northern lights				1	2			1	1	1	2	4	
St. Elmo's fire						1							
Whirlwinds							1				1		
Phenomena:													
Atmospheric electrical display											1		
Submarine earthquake									1			1	
Phenomenal tide rip							1						

Respectfully submitted.

JOHN DOWNES,
Lieutenant U. S. Navy.

Lieut. G. L. DYER, U. S. Navy,
Hydrographer.

BRANCH HYDROGRAPHIC OFFICE,
Maritime Exchange, New York, N. Y., July 1, 1888.

SIR: In obedience to circular dated Washington, June 15, 1888, I have the honor to respectfully submit the report of this office for the fiscal year ending June 30, 1888.

The appended table marked "A" presents concisely, in detail and aggregate, the work performed by this office during the last year.

The hurricanes in August were remarkable both in energy and number; the numerous reports received and forwarded were most satisfactory, and furnished data which is of the greatest value in the study of these destructive meteors, enabling the seaman to plot their tracks, and affording increased knowledge of the laws of storms. In discussing these hurricanes with many of the captains who had experienced them, this office has been gratified to learn of the great assistance which the storm-card (published on each Pilot Chart) has been to those who followed its directions implicitly and intelligently; two cases were found in which the captains took the wrong tack with most disastrous results. An old captain, who has for many years traded to the West Indies, volunteered the information that, differing at first from some of the instructions issued by the Hydrographic Office, he had, when occasion offered, concluded to follow the advice given, as he belived that the officers who had made a study of the matter were able to give advice; the first August hurricane found him at sea in a bad position; he followed the directions contained in the latest Pilot Chart, and not only escaped without any injury, but was enabled to take advantage of the favoring winds which followed and made his best run; as a natural consequence he is satisfied to sail his vessel by the directions given on the Pilot Chart. The ingenious and graphic method proposed by the Hydrographic Office of determining the distance from the storm center and general track, by the fall of the barometer, at once met with approval; the practical demonstration of the same alone remains to be proven. The several articles on West Indian hurricanes, as issued from month to month by the hydrographer, have been most highly appreciated, the language being such as was at once comprehended and approved of by the average practical master. Through the interest taken by the general sea-faring public in the work of this office, we are enabled to obtain many valuable hurricane reports from vessels abroad, giving reliable data which would otherwise have been lost.

On October 1 the Hydrographic Office assumed charge of all ocean meteorological reports, a work which had previous to this time been performed by the Signal Service and Hydrographic Office. The blanks for simultaneous observations issued by the Signal Service were allowed circulation until January 1, 1888, the Hydrographic Office issued temporary blanks to cover certain ground. The working staff of this office was at the same time increased by the addition of a civilian boarding assistant and stenographer. Experience at that time showed that the duties of the stenographer could for a while be dispensed with, and as the increased work, both in the office and outside, caused by the absorbing duties at one time performed by the Signal Service, became more apparent, it was decided to replace the stenographer by a second boarding officer, so that the recommendations made last year as to the proper status of this office were in a measure realized. On January 1, 1888, the Signal Service blanks were all withdrawn, and their places supplied by others issued by the Hydrographic Office; the results have been most satisfactory. Not only have the vessels frequenting this port been supplied, but packages have been sent to all the prominent steam-

ship companies of Europe. Since the date of issue, only six months this office has obtained 1,300 voluntary observers who carefully follow the instructions given, and promptly forward their reports. I can not place before you too strongly the great value that this mass of information must attain. The study of ocean meteorology is one that is becoming daily more important to every maritime nation of the world. Not only are we enabled to benefit commerce by recommending routes for vessels, both steam and sail, where the best conditions for favorable passages are to be found, but can also with fair accuracy forecast the probable limits of fog, which last is by far the most dangerous obstruction to navigation of all the dangers of the deep. As a field of study for the meteorologist, or for the naval officer who desires to increase his knowledge of ocean weather, the fund of information which is daily being augmented and compiled at the Hydrographic Office offers an advantage which can not be overestimated. The present blanks are in many ways most admirable, being strewn broadcast over the world; we are, through them, receiving more reliable and numerous reports as to the position and drift of derelicts, buoys, and ice. There is, however, a point which can still be gained in regard to the coasting trade. The captains of the vessels occupied in this business can not, as a general rule, follow the requirements of form No. 105, and it would be well to issue such a blank for reports of fogs and wrecks, with a part to be devoted to any storm met; form No. 101 would be well adapted for purpose. Unusual storms, such as hurricanes, cyclones, and the blizzard, require more detailed reports. The leaves of the storm journals are admirably suited for this purpose, and it would be well to supply a sufficient number of these for issue to meet the requirements of the coming summer hurricanes.

In December, the great Nova Scotia raft, which broke adrift from the steam-ship *Miranda*, became a standing menace to vessels bound to this port. By the advice of this office, the Maritime Association of the port of New York requested the honorable Secretaries of the Treasury and Navy to send Government vessels to remove, if possible, the danger. This office has been very much engaged in giving information in regard to the latest reported position of this danger, and discussing the probable course it would take, it being always held that the raft would soon go to pieces. The report of Commander McCalla, of the U. S. S. *Enterprise*, was most reassuring.

At the request of the inspector third light-house district (Commodore Benham) this office made an exhaustive search for opinions from captains of the value of the two systems of bell-buoys placed in the lower bay, namely, the single and double bells at the wreck of the bark *Quickstep* and No. 8 in Swash Channel. A circular was issued by this office and most satisfactory responses obtained. The results seem to have met with the approval of the inspector, as the two bell-buoys are still retained and captains find them a great aid in foggy weather, as their vast difference in sound enables a master to locate his vessel when nothing is to be seen.

The ice this season has been very late in making its appearance in any quantities; up to May 1, only 30 reports of ice had been received as against 120 for the same period of time of the year previous. The prevailing northeasterly winds for a long time banked the ice off the Newfoundland coast, accounting, in a measure, for its not reaching farther to the southward and eastward. As the season advances this office is greatly occupied in furnishing information as to the general position and movement of the ice. Captains of transatlantic steamers call on the

eve of departure to obtain the latest information, the daily reports of ice being plotted (as was the custom last year) on each chart issued; in addition to the information furnished by the weekly supplement of the ice we have at the request of certain steam-ship managers furnished them with copies of all ice reports received. The opening of navigation in the St. Lawrence River and Gulf is an important matter to the New York market, and the subsequent movement of the ice in this vicinity is a subject of interest to those wishing to charter vessels for that trade. Having supplied vessels trading from England and France to Quebec and Montreal with the Hydrographic Office blanks we have received most reliable and valuable reports of the ice which have never before been made to this office.

In December last the British steam-ship *Newcastle City* struck on a shoal to the southward and westward of Nantucket new south shoal light-ship. The captain visited this office, and after carefully laying down the course and estimating the distance run, the fact became obvious that the *Newcastle City* struck on the 4½ fathom spot as shown on Hydrographic Office chart No. 941. The vessel was drawing 20 feet at the time, but it was low water and a northwest gale had been blowing for nearly ten days, materially lessening the water on the shoal; the heave of the sea at the time was amply sufficient to cause the vessel to find the bottom. and as she hit aft the theory is fully approved by the facts in the case. The steamer backed off after twenty minutes and finally sunk about 4 miles south of the light ship. The captain stated that nothing less than 9 fathoms was shown on his British admiralty chart to the southward and westward of the light-ship, and, according to the British sailing directions, he was clear of all dangers and had shaped a safe course. Investigation showed that this shoal did not appear on any of the British charts used by the transatlantic vessels frequenting this port. In order to warn mariners of this dangerous locality to vessels of deep draught this office published in the New York Herald a notice calling attention to the fact that this shoal, which had proved dangerous, was shown on the Hydrographic Office chart No. 941 and that applicants to this office would be given its proper location with all necessary data. A number of captains availed themselves of this opportunity and either had their own charts corrected or procured copies of the Hydrographic Office chart. As a matter of interest it would be well to state that at the official investigation held in England on the grounding and loss of the *Newcastle City* the captain was cleared and had his certificate returned to him on the ground that the shoal did not appear on the British admiralty charts.

In this connection the peculiar opportunities of the officer in charge of this office to discuss daily with the most intelligent sea-faring men the value of the aids to navigation furnished by the Government have impressed me with the conviction that certain changes and additions might be made with advantage, and this matter is embodied in a separate report.

The attention called by the United States Hydrographic Office to the use of oil has been most fruitful of results; the reports of the last few years have been widely circulated and have caused the maritime world to take a great interest in this subject. The French S. S. Compagnie Générale Transatlantique have issued most thorough and interesting instructions to the captains of their vessels as to its use whenever the occasion offers. The pamphlets of Admiral Clouet and Captain Karlowa are great additions to the literature on this subject. Many mechanical means have been devised for the distribution of oil and it has become

quite an item in the manufacturing world. The rocket patented by a officer of the German steam-ship *Werra* appears from experiments t be productive of most excellent results. The great storm of March 1 to 14, which was so disastrous in its results, was as severe as it was expected. This office has forwarded most valuable reports of nume vessels exposed to its fury, and has been enabled to glean evidence the value of oil on occasions of this sort.

The Pilot Chart not only holds its previously attained high positi in the estimation of mariners, but has also come in for a great a of praise as regards the additions and improvements. Plotting the li its of fog as reported for the month previous with the probable extent the same for the current month was a most decided improvement. Ice derelicts are dangers of which a good lookout in ordinary weather w give warning, but the dangers which lie hidden in the dense fogs are u known quantities and luck enters largely as an element in their avoidanc The temperature test in certain localities will be an assistance in deno ing the vicinity of ice, but in the Gulf Stream bound east this can not relied upon. The publication on the Pilot Chart of the average baron ter readings of the North Atlantic was most satisfactory and has be of great assistance to the captains in the North Atlantic service. Th have also expressed their approval of the diagrams of wind circula which were issued on the proposed Atlantic routes for December. T subject of safe transatlantic routes at all times is one which has tak a great deal of work. There is a widely expressed wish to have cer routes laid down which alone shall be taken by all liners, but the subje is one which has hardly attained a tangible shape. With the rush business and the apparent growing necessity of quick passages, unle certain routes are made compulsory for all vessels, each captain will, far as the orders of his company permit, take the route which, in h opinion, will give the least number of days in crossing. Head w and storms are hardly taken into account with the great steamers p between New York and Europe; ice in clear weather is not regarded such a serious obstruction, the greatest danger being fog, and it will found that, as far as practicable, the shortest route which will clear t fog-banks will be taken and vessels will go as far north as possible, e in some cases risking twenty-four hours fog.

The rules of the road, particularly those in regard to fogs, have be of late attracting more than usual attention, the matter having be brought to the serious attention of ship-owners by the number of c lision cases which have occurred during the last year. The case of t *Britannic* and *Celtic* showed conclusively the present inadequate law regard to speed, leaving each commander to have his own ideas as t moderate rate. It is to be hoped that the matter will be thorou sifted by the proposed International Marine Congress and the be means taken for avoiding these collisions in the future.

A trade has been springing up on the Orinoco River, the banks a vicinity of which contain many valuable mines whose ore is becomi a very marketable commodity. The charts which we have consult are simply unreliable. We have had the opportunity of conversi with two captains who have brought their vessels from the Orinoco a have obtained all the information possible of this locality. The Hydr graphic Office, British Admiralty, and charts issued by a British hydr grapher (civilian) have been all overhauled and we find no two alik in addition to which the captains inform us that no single chart is co rect. In view of the strained relations which have been reported to e

ist between Great Britain and Venezuela, with the interest which the policy of the United States causes our country to have in this locality it would seem most necessary that we should, as soon as possible, be furnished with reliable information in regard to the bar and approaches of this great water-way. That it needs surveying is most apparent, and that it becomes our duty to protect ourselves in this part of the world, by making the necessary surveys, seems obvious.

I would again urge the issuing by the Hydrographic Office of charts of Sunda Straits and the Eastern passages. We are lamentably deficient in this locality, as well as in many others. England is our great base of supply and with the necessity which is apparent to all maritime nations, that of independence, it seems as if the work of issuing charts so that we can have our own to rely upon in case of need should be driven as rapidly as possible. The British charts are most expensive when purchased here, and the demand for cheaper publications, such as those of the Hydrographic Office, is excessive. The sailing directions for the Indian Ocean, recently issued by the Hydrographic Office, is much appreciated. It is concise, convenient to handle, nicely and serviceably gotten up, and most moderate in price. The subject of sailing directions is one demanding serious consideration—as with the charts—we find that we have to rely on foreign nations for the necessary information, not having publications of our own; many of the books employed for the purpose are practically of no use, being old and obsolete. Naval officers could be advantageously employed in times of peace by being detailed for this work, being ordered to cover certain ground and held responsible for the accuracy of their reports. In this way the present sailing directions could be corrected by going from port to port, interviewing pilots, fishermen, etc., traveling on coasting vessels and gathering data which would prove of the greatest value. I would suggest that an effort be made with the State Department to extend the usefulness of the consular service in gathering information. The results would be most valuable if they were requested to make monthly reports concerning the approaches to their respective cities, with all points of interest relating to anchorage, trade, and any matter of improvement which might take place. Changes are continually going on which we should know. Every effort should be made to gather all the information possible; no item should be considered of too little interest to be reported. The matter could best be sifted by those engaged in compiling such data at the Hydrographic Office, and they could be able to judge which should be rejected as of no value and which retained. When the other sailing directions, now in course of preparation, are issued, we will, without doubt, be supplied with works equal to any published. In connection with this point, I would call your attention to the fact that this office is daily beset with inquiries as to the names of consuls and consular agents at different ports. Each branch should be supplied with the latest issued list of these officers, and when any changes are made by the State Department information should at once be furnished the Hydographic Office so that the office lists could be kept correct to date.

The gnomonic chart of the North Atlantic Ocean is most highly spoken of, the more it is used the more popular it becomes, and hardly a steamer engaged in the North Atlantic trade will be found without one.

This office has spent much time in describing the construction and use of charts on the polyconic projection, finding, as was the case last year, that the percentage of captains who had any rational ideas on

the subject was very small; in fact it has been reported to this that certain Coast Survey charts were faulty in construction simply be cause the navigator having been brought up on a Mercator's chart had never heard of any other projection. Despite the claims made by its advocates for great accuracy, this method of projection does not grow in favor; many captains prefer to use the Hydrographic Office general sheets, although on a smaller scale, rather than run on the larger Coast Survey charts, believing themselves treading on ground they do not fully understand.

The cases in courts of admiralty in which the officers attached to this office have been called to testify have been on the increase, and, in fact, this office has been called upon to give information on so many subjects that the limits of this report prevent their being enumerated.

The subject of barometer comparisons is one demanding careful attention. It has been noticed in regard to mercurial barometers that comparisons taken on day of arrival differ, in many cases, most radically from those taken of the same barometer in the same position after the vessel has been in port several days. It is now the custom of this office to compare these barometers as soon after arrival as possible, and to take a second comparison before sailing, hoping that a table could be compiled which would be productive of good results, and at the same time serve for correcting this unlooked-for phenomenon. The cause of these differences is still a matter of theory, and conversations with the most noted instrument makers in this city fail to throw any satisfactory light on the subject. Primarily, it may be caused by a poor instrument, but when it is considered that many of the barometers in question are those of the most noted instrument makers in the world, this hypothesis seems untenable.

The observers for the Hydrographic Office should be furnished with instruments of standard pattern, both barometers and hygrometers; other nations engaged in this work have done so, and if it is expected to get uniform good results and as satisfactory reports as are obtained by the meteorological offices of foreign nations we can not afford to be behind in supplying the necessary tools for the workmen. I deprecate the giving of bonds, as was the custom of the Signal Service, for the captains of the vessels are responsible parties and their signature on a receipt for the instruments would be sufficient. Most of the Signal Service barometers have been called in, and it would be well to request the Chief Signal Officer to transfer these instruments to the Hydrographic Office for issue to observers, at the same time urging an adequate addition to the appropriation for the purchase of new instruments.

I beg leave to call your attention to the increased amount of worl performed by this office in comparison with that of the year endin June 30, 1887, due, in a measure, to the more widely diffused knowledg in regard to its methods. The assuming of the work which the Signa Service had in hand by the Hydrographic Office has, of necessity, en larged the field of operations and increased the labors, with, however most satisfactory results in every way. I would desire your notice the number of applicants for information with the increased circulat and issue of Notices to Mariners and total number of barometers c pared. These, in themselves, show plainly that time has not been n spent. It must also be remembered that this office is open every da Sundays and holidays not excepted, an officer being on duty to mak out the report for the Mascart cablegram. The public schools hav been furnished with the regular issue of the Pilot Charts, and we are in

formed that they are considered subjects of great interest and instruction to the scholars. The New York Herald publishes monthly an abstract of the Pilot Chart, and has assisted in bringing the office before the public.

I would strongly recommend the issue of the weekly supplement be on Thursday of each week instead of Friday, as is now the custom, so that they may reach this office and be delivered on board the outgoing vessels on the latter day. Saturday is the great sailing day in New York, and the weekly supplement contains, particularly during the ice season, much valuable information. When the tide serves early the Saturday steamers leave without the supplement—a matter often much regretted by the captains.

To the press of this city our thanks are due for their uniform courtesy and assistance, materially aiding us in the discharge of our duties. The collector of the port has kindly granted permission to representatives of this office to board all incoming vessels by means of the revenue-cutter—a privilege which is most thoroughly appreciated. To the office of Ship News we are greatly indebted for their kindness in taking charge of all reports received at quarantine, and particularly for their collection of the same on Sundays. The dock commissioners and port wardens have extended offers of assistance which will prove of great value. To the pilot commissioners, the secretary of the board, and to many of the lots this office desires to return thanks for most valuable information th which they have furnished us.

The subject of removing dangerous wrecks along the coast has received a most satisfactory recognition from the Department, and the work of the U. S. S. *Despatch* has been a subject of much praise and appreciation. The removal of dangers, either real or imaginary, has relieved both captains and pilots of much cause for apprehension. Although the *Despatch* has done good work in this connection, yet she is not suitable for this kind of work, and I would earnestly recommend that a vessel be built for this special service, one that could go out in all weathers, with every appliance specially adapted for use in heavy weather.

I would present to you in the strongest light possible the totally inadequate quarters which are provided for this office and beg the most serious consideration of this subject, with the request that every means may be exhausted until the evil is remedied. Discipline, such as must be observed on board ship, is hardly applicable to an office of this description; at the same time, the present state of affairs, necessitated by the cramped space allowed, should not exist. The officer who assumes charge of this office finds that his field is a most extended one, that his opinion is sought and taken on subjects which demand close attention and care. It is apparent when the duties devolving upon officers representing the naval branch of the Government are such as to bring them in contact with men of business who desire opinions upon serious matters, and when such business men are accustomed to enjoy surroundings consistent with their position, that the appearance presented by the offices of the New York branch are hardly such as would impress one with the dignity which is an inseparable part of the naval establishment. Not only is this a subject which touches the pride of all concerned, but it is a matter of personal discomfort and detracts from the advantageous workings of the office. The inside work has so much increased that enlarged accommodations are imperative if the work is to progress as in the years past, which rate of progress, indications show, can be maintained with proper quarters, staff, and appli-

ances. It has been my custom to attend personally to the Mari cablegram, devoting the hours between 10 a.m. and noon in compili data for this important feature. At the expiration of this time t officer in charge is at liberty to discuss such matters as may be brough to him. It is certainly not too much to expect that such accommoda tions should be provided as will secure the requisite quiet and p vacy for matters of this sort. It is only necessary to see the prese quarters to be impressed with their want of adaptability for the se ice. The office in which the charts are corrected, ships furnished sailing directions and charts are preserved, and general informati given, is even less suited for the purpose than the other. One chart ta is alone provided; this is always occupied with necessary work, wh must be interrupted when captains are desirous of consulting char and books as to routes; when one officer is engaged in giving inform tion the space is so limited that all other work must cease; the sm quarters allotted prevent more than two or three at a time to seek d sired information. When packages are made up of the "Extracts covering traveled routes, we are forced to utilize any corner or par the exchange which is not then in use, leaving an uncertain element our work. This office requires a large room for which rent can be pai and a feeling of independence which can not now exist will be sure follow. This room should be so partitioned that the officer in char can have a private office; each member of the staff should have a su able desk or table, and this must include the boarding assistants. Wh their outside work is completed each day they have still to fill out t forms in regard to barometers compared, to submit their written rep of information gathered, and to do other necessary work which re a suitable desk. Two chart tables are as few as can be gotten along wi when the work is properly carried on. The sailing directions shou have convenient shelves, the chart chests should be conveniently locate places should be given for stowage of notices to mariners, beacon a buoy and light-house lists—all of which are now so crowded that is a matter of labor to get at them. A stenographer should be add to the working staff, although the services of one were dispensed wi to procure a second boarding assistant. The necessity of a rapid accurate type-writer and stenographer becomes daily more appare Two assistants for the outside work are absolutely necessary—a sta ment which can not be controverted when the distance of the water fr in New York which has to be traversed is considered. The officer charge, in addition to the messenger who keeps the books, should ha at least two naval officers as assistants; this is the least number w which the present work can be carried on. Two energetic and effici assistants who are interested in the work will enable the office to ke up its present reputation, as the desire and intention is to incre and not to retrograde, and if proper quarters are furnished ample w can be found to employ a third assistant. The Maritime Associat has now for rent a room connected with the floor of the exchange wh is in every way admirably adapted for the work of this office. I our great desire to rent these quarters, and an appropriation for t office of $7,000 would enable it to procure everything necessary for proper equipment and rent, and at the same time would place this o on the proper footing, which has so long been the desire of all those terested in its work. The Maritime Association has done all it co consistent with its interests in supplying quarters free of rent, and i to be hoped that the necessary appropriation will be made, which v

enable this branch to be placed on the footing becoming the dignity and utility of a Government office.

I append to this report (marked B, C, and D) a few of the many notices in regard to the opinion held by those who have sought information at our hands.

In conclusion I beg to express to the officers and members of the Maritime Association of the port of New York my sincere thanks and appreciation of the great kindness and consideration with which this office has been treated; helping hands have been lent, words of encouragement said, and much assistance has been given by them to aid in the working and maintenance of the New York Branch Hydrographic Office.

B.

[The Mechanical News, New York, April 15, 1888.]

Citizens of a free country are disposed to consider it one of their inalienable rights to find fault with their Government, its methods, and its instruments. But the fact is, and we mention it as a matter of simple justice, that when the complaining citizen comes in actual contact with public officials, whether in the civil, military, or naval service, he is oftener than otherwise agreeably surprised by having his business politely considered and efficiently attended to. There are exceptions, of course, for human nature is as variable and imperfect in public as in private life. But the rule, if we may judge from considerable experience, is as we have stated. We are led to make these general observations incidentally to an acknowledgment of our obligations to the Branch Hydrographic Office, U. S. Navy, located in the Maritime Exchange, Produce Exchange Building, in this city, under the care of Lieutenant Cottman and his assistants, Lieutenant Halsey and Ensign Luby. It gives us pleasure to say that this, at least, is one branch of the public service which is characterized by courtesy and promptness in its relations with the public.

C.

[Seaboard, New York, May, 1888.]

The directors of the Maritime Exchange, being painfully aware of the insufficient room allotted to the Branch Hydrographic Office in this city, and being firmly impressed with the value of that office to navigators, have adopted a resolution urging Congress to grant a sufficient appropriation to maintain its efficiency. The resolution has complimentary words for the several branch hydrographic offices, and asks the co-operation of all commercial bodies on the sea-board, to the end that the Hydrographic Service may be given an opportunity to attain a true development. We have repeatedly referred to this matter, and pointed to the beggarly accommodations possessed by the branch in this city. It has been a source of wonder that the business of the office here could be properly attended to in the limited space allotted, and much credit is due the officers in charge, who have ever faithfully performed their duty under the greatest possible disadvantages. Now that the Maritime Exchange has taken the matter up, we expect that no time will be lost putting the New York office on a proper footing, both as regards accommodations and the necessary help to maintain its acknowledged efficiency.

D.

[Annual report Maritime Association of the port of New York for 1888.]

But probably the most important to us is the Branch Hydrographic Office of the Navy Department on our floor. The practical appreciation of its usefulness is shown by an increase of 51 per cent. in its operations over those of the previous year, 228,000 applications for information having been answered. It is constantly supplied

with charts, sailing directions, etc., for all waters, kept corrected to date, latest information attainable.

On the 1st of October it assumed the collection of marine data from inc sels formerly performed by the Signal Service. During the past year boarded 6,341 steamers and vessels on arrival, and collected a valuable mass ligence concerning icebergs, derelicts, and other dangers to navigation. It is valuable adjunct to the exchange, which is equally necessary to it. The assigned to it have become entirely inadequate. It is therefore to be hoped Government will enable it to take more space and compensate us for it of cost to us.

	1887.						1888.					
	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.
Vessels visited	452	543	586	435	507	439	448	489	506	588	551	57
Charts corrected	2	12	......	....	.....	124	68	72	62	90	226	54
Barometers compared	100	107	96	227	333	324	293	299	349	310	333	30
Thermometers compared	43	1	74	123	68	44	11	58	28	18	4	18
Aids to navigation distributed:												
Pilot charts	671	1,027	1,003	970	1,230	1,210	1,099	1,245	1,394	1,621	1,591	1,73
Weekly supplements	1,344	1,232	1,280	1,190	1,046	1,181	1,311	1,546	1,926	1,618	1,655	1,97
Light lists	69	78	58	72	56	40	37	45	55	80	58	12
Day-mark lists	143	239	187	258	202	146	134	163	196	287	159	19
Rules of the road at sea	65	91	31	61	61	39	42	45	55	67	49	5
Notice to mariners	6,184	7,972	7,897	9,183	7,914	6,441	6,611	7,256	18,192	21,393	11,979	13,50
Pamphlets on various nautical subjects	136	196	231	156	137	86	106	69	256	277	254	26
Reports collected and forwarded:												
Storms at sea	3	58	122	21	90	78	99	69	110	103	66	
Trade-wind limits	59	79	38	93	41	27	90	90	64	138	67	
Water-spouts	3	1	3	1	.....	2	7	5	6	9	9	..
Fog	128	75	82	54	50	32	18	54	50	46	175	
Ice	48	43	13	1	.....	1	3	7	7	4	24	
Earthquakes	......	1	.....	.....	.....	.....	.....	.....	......	......	......	....
Currents	1	1	.....	1	1	.....	1	1	......	1	2	
Unusual phenomena	5	2	2	2	.....	2	1	6	2	3	4	....
Buoys adrift	10	4	9	4	4	11	14	14	13	30	14	
Wrecks, derelicts, etc	31	65	72	36	49	53	62	84	102	78	79	
Whales	1	....	1	1	....	....	....	2	3	......	4	
Use of oil in gales	......	3	10	3	2	6	1	2	5	10		
Track charts	......	1	......	1	3	5	5	6	5	3	......	....
Abstract logs	1	......	3	....	1	....	20	27	19	81	25	
Simultaneous observations	.....	.....	.....	.	146	194	197	293	204	197	265	2
Information furnished	12,170	12,493	13,875	4,707	4,939	5,875	4,865	5,008	9,078	6,093	5,646	6,2

Respectfully submitted.

V. L. COTTMAN,
Lieutenant, U. S. Na

Lieut. G. L. DYER, U. S. Navy,
Hydrographer.

BRANCH HYDROGRAPHIC OFFICE,
Philadelphia, Pa., July 1, 18

SIR: I have the honor to submit the following report of the tions of this office for the fiscal year ending June 30, 1888:

The growing appreciation of the office, not only by sea-faring men to an important degree by the general public, is especially gratify

I regret, however, to have to state that owing to the lack of assistants for some months I found it impracticable to carry on the duty as it ould have been done.

Ensign J. H. Hetherington, U. S. Navy, was detached August 31, 1887; Ensign H. B. Wilson, U. S. Navy, reported for duty November 27, 1887, and is still attached; Ensign Joseph Beale, jr., U. S. Navy, was on duty here from December 1, 1887, to February 17, 1888. The messenger formerly employed was discharged September 30, 1887. The services of an intelligent messenger are very necessary, and I earnestly recommend that one be allowed.

Notwithstanding the insufficiency of force and the increased work owing to the transfer of the collection of marine data formerly done by the Signal Service U. S. Army, I take pleasure in calling your attention to the decided increase in work performed during the year. Although this is gratifying I am sure that even this would be exceeded if it be deemed expedient to allow the messenger recommended above.

The reliability of the monthly Pilot Chart is thoroughly appreciated by mariners, and few vessels cross the Atlantic without them. Its introduction into the public schools in many of the cities and towns of Pennsylvania, New Jersey, Delaware, and the Eastern Shore of Maryland, by this office, has accomplished much in disseminating valuable and interesting meteorological information.

The interest of ship-masters in the publications issued by the Hydrographic Office is demonstrated by the number of their observations, the increased accuracy of the same, and the promptness with which they are forwarded. Nearly all the captains of steamers trading to this port and many of sailing vessels assist in this work in which they have so deep an interest.

A substation or office should be established at the Delaware Breakwater, where many vessels call for orders. A great deal of information could thus be obtained from them which is now lost. I feel confident that this suboffice could be maintained at a trifling expense compared with the results.

Inquiries are often made for charts of the United States and Mexican coasts of the Gulf of Mexico, and charts on one sheet of the West Indies and the Gulf of Mexico. I would recommend the publication of these sheets, which I think would find ready sale.

The time-ball has worked exceedingly well, the failures to drop when time was received being very few.

I have to thank the Maritime Exchange and many firms of shipping agents for courtesies received, especially the exchange, as no rent has been paid for the space occupied by the office since September 30, 1887.

The following table presents the work performed during the year:

	1887.						1888.						
	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Reports forwarded:													
Trade-winds	10	14	2	3	4	1	20	4					[illegible]
Ice	16	33	4	3	4		1	3	5	4	10	23	[illegible]
Wrecks	29	61	74	82	106	157	158	197	241	253	137	102	[illegible]
Fog	2	4	8	3	7	7	2	11	2	7	14	42	[illegible]
Buoys adrift	8	1	2	7	3	9	6	6	13	16	13	20	[illegible]
General information		2	2	6	1	8	3	3	5	2	6	3	[illegible]
Water-spouts		1	1		1		4	4	3		1	3	[illegible]
Whales	2		2	1	2		2	3	1	1	6	5	[illegible]
Meteorological journals		3				3					2		[illegible]
Meteorological reports				22	33	29	18	41	26	33	48	51	[illegible]
Data for Mascart cablegrams								10	12	16	32	29	[illegible]
Ports described									2				[illegible]
Storms		7	5	4	14	21	15	17	22	17	6	10	[illegible]
Meteors										1			[illegible]
Location of fishery fleet		1	1		1						4		[illegible]
Use of oil in storms		1	3	1	6	14	6	3		3		2	[illegible]
Currents		1			2	1			2	1	9	6	[illegible]
Bottles picked up				1							1		[illegible]
Shoals reported	2		1										[illegible]
St. Elmo's fire										1	1		[illegible]
Track charts				2			1				2	3	[illegible]
Earthquakes			1										[illegible]
Log abstracts		1					3	2	1				[illegible]
Buoys missing	1				2								[illegible]
Articles distributed:													
Pilot charts	344	467	446	294	466	357	422	385	390	385	461	399	4,816
Supplements to same	482	683	531	498	723	599	546	710	576	742	951	763	7,80[illegible]
Supplements to same (water-spouts)									160	62	9	8	[illegible]
Supplements to same (cyclones)			63	62	45	52	3		5	15	9	7	[illegible]
Notices to Mariners	6,473	8,106	10,155	18,070	7,859	10,582	6,727	12,183	16,149	20,670	21,152	15,176	144,732
Light lists	48	42	47	30	52	55	32	43	44	70	51	39	[illegible]
Buoy books	244	162	182	176	204	232	128	231	254	268	196	124	2,401
Hints on West India hurricanes	12	14	42	22	17	63	32	13		27	8	4	254
Pamphlets on use of oil in storms	21	27	53	27	27	102	36	12		35	7		347
Meteorological journals	6	7	6	3									22
Meteorological charts	1										24		25
General sailing charts		16	24	21	13				2				76
Telegraph charts	2				4	1	6						13
Fishery treaties charts										10	1		11
Reports of the hydrographer					22								22
Lists of United States vessels	2		5			1			1	1			10
Registers of the United States Navy											7		7
Catalogues of Hydrographic Office charts										2	8	2	12
Reports of the Commissioner of Navigation											2		2
Signal Service Weather Reviews										19	46	49	114
Coast Survey tide tables								2		1			3

	1887.						1888.						
	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Work done:													
Vessels visited	74	267	180	20	99	157	171	192	156	178	211	175	1,880
Information given to individuals	288	472	1,057	806	1,040	749	806	1,093	962	1,216	1,989	1,810	12,288
Barometers compared	28	145	87	11	49	85	79	68	113	112	139	91	997
Chronometers compared	4	10	9	17	9	34	27	4	3	9	8	4	138
Letters to captains	14	6	3	86	31	26	24	.....	.....	.....	.....	.....	190
Office charts corrected	39	78	65	111	104	42	86	113	163	142	111	143	1,197
Office light lists corrected	31	30	36	46	59	47	28	56	85	69	47	31	559
Vessels' light lists corrected	25	51	61	40	42	.....	28	47	32	98	54	23	501
Vessels' charts corrected	11	2	6	.....	.....	17	1	9	4	1	.....	2	53
Buoy books corrected	141	75	129	157	72	258	206	306	182	284	276	44	2,130

Respectfully submitted.

W. P. CONWAY,
Lieutenant, U. S. Navy.

Lieut. G. L. DYER, U. S. Navy,
Hydrographer.

U. S. BRANCH HYDROGRAPHIC OFFICE,
BOARD OF TRADE, 54 EXCHANGE PLACE,
Baltimore, Md., July 11, 1888.

SIR: In obedience to instructions, I submit the report of the work done at this office for the fiscal year ending June 30, 1888.

On the 5th of November, 1887, I relieved Lieutenant Graham, U. S. Navy.

The present location of the office is a serious drawback to its usefulness; a change is not considered advisable, however, until quarters in the custom-house can be procured, after the removal of the post-office to its new building.

The location of the time ball on the Baltimore and Ohio Railroad building is such that it can not be seen from the wharves in the harbor, where most of the sea-going vessels lie, and on this account is of no benefit to masters wishing to get their own chronometer comparisons and rates. I would suggest that, if possible, arrangements be made to hoist the ball on the tower of the observatory in Federal Hill Park, where it will be of more direct use to those for whom it was intended.

No meteorological journals have been issued during the year; not more than three vessels sailing from this port in the past year had the proper instruments for recording observations; some old observers refused to keep the journal requiring observations every two hours, while perfectly willing to take new form 105*a*–1888. The new forms have been issued to all vessels that would take them, and old observers who heretofore kept the Signal Service blanks speak well of the arrange-

ment and convenience of the "Reports of Marine Meteorology." I: this connection, as some of these officers keep careful and good records and take much interest in the work and as the office can not furnish with instruments, I would suggest that the officers in charge o branch offices be allowed more latitude in giving charts or other cations specially desired.

The thanks of the office are due to the president and secretary of the Board of Trade, the president and officers of the Merchants' Exc the press of the city, and the various shipping firms, for courtesies assistance in carrying on its work.

The following is a statement of the work done:

	1887.						1888.						
	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Vessels visited	199	180	164	2	6	66	81	136	46	117	107	65	[illegible]
Barometers compared	49	47	44	2	4	45	37	46	32	32	17	7	[illegible]
Chronometers compared	55	34	55	24	25	39	38	37	35	36	56	41	[illegible]
Vessels' charts corrected		1			2					2	14	14	[illegible]
Pilot charts distributed	407	324	269	172	188	294	200	200	200	200	200	200	[illegible]
Supplements distributed	559	485	608	433	338	463	557	374	521	285	695	568	[illegible]
Notices to mariners distributed	2,274	3,460	1,485	1,008	1,139	986	2,076	3,061	5,523	2,163	3,990	3,048	[illegible]
Light lists distributed	22	25	27	1	4	7	7	11	5	30	28	1	[illegible]
Buoy book distributed	127	209	110	22	73	25	22	92	38	34	3	2	[illegible]
Water-spout supplements distributed									32	31			[illegible]
"Transatlantic steam-ship routes" distributed		7	41				25						[illegible]
Information to shipmasters and others	95	109	127	14	18	32	19	21	17	5	10	10	[illegible]
Reports collected and forwarded:													
Storms	2	17	16	2	9	13	14	13	13	8	12	5	[illegible]
Trade-winds	12	16	10	2		3	6	5			1		[illegible]
Ice	5	5	1				1	3	6	1	5	15	[illegible]
Fog	7	8	12	1	6	4	3	16	5	7	10	23	[illegible]
Equatorial rains	4		4	2		1	3	1					[illegible]
Water-spouts					1					2	1		[illegible]
Earthquake at sea							1						[illegible]
Wrecks and wreckage	3	3	11		1	5	5	9	12	4	11	10	[illegible]
Buoys adrift	3	2		1			3	1		2	2	2	[illegible]
Whales	1		2					1			1	2	[illegible]
St. Elmo's fire	1												[illegible]
Tide rips	1	1											[illegible]
Discolored water	1										1		[illegible]
Use of oil	1		1		1		1		1	1			[illegible]
Tonnage across the "Banks," to and from Baltimore												1	[illegible]
Storm of March 12–14									1				[illegible]
Reports of marine meteorology								13	19	22	28	27	[illegible]

Respectfully submitted,

JOHN P. PARKER,
Lieutenant, U. S. Navy.

Lieut. G. L. DYER, U. S. Navy,
Hydrographer.

U. S. BRANCH HYDROGRAPHIC OFFICE,
Maritime Association, New Orleans, La., July 1, 1888.

SIR: The regular duties of this office have been attended to throughout the year and in addition much has been done to further extend and popularize its purposes as an important and useful factor in sea-faring life, so much so that at present its work is well known and utilized along the entire Gulf coast.

In addition to the co-operation of the ship agents at Pensacola, Fla., and Galveston, Tex., mentioned in the last annual report, Mr. G. J. Robertson, of Mobile, Ala., has volunteered his services for the same purpose, which have been gladly accepted.

The useful and interesting meteorological information contained on the Pilot Chart has enabled it to secure a place in several of the public institutions of learning in Louisiana, Alabama, and Texas, as a means of imparting a practical knowledge of the physical geography of the sea to the students of those institutions. Further efforts will be made to disseminate these charts among the schools of the South.

In order that the people of New Orleans might have an opportunity of judging what was being done by the branch offices, I, at the request of the Chamber of Commerce, on January 3, 1888, lectured at Tulane Hall upon the purposes for which the branch offices were established, and received from that body afterwards the following letter:

NEW ORLEANS CHAMBER OF COMMERCE,
New Orleans, January 24, 1888.

Ensign F. R. WALL,
In charge of the New Orleans Branch
of the United States Hydrographic Office:

DEAR SIR: It affords me great pleasure to comply with the instructions of this chamber in transmitting to you the following extract from the minutes of its annual meeting held last night:

"Whereas the Chamber of Commerce of New Orleans highly appreciates the efforts of Ensign F. R. Wall, U. S. N., in charge of the New Orleans branch of the United States Hydrographic Office, for introducing the course of public lectures inaugurated by this chamber on Tuesday night, January 3, by addressing the audience at Tulane Hall, it is hereby

"*Resolved,* That a vote of thanks be tendered by this body to Ensign F. R. Wall for his able and interesting lecture."

Respectfully, yours,

D. L. MITCHELL,
Secretary.

The plan of the main office to obtain uniformity and certainty in the gathering of the data for the Pilot Chart by the adoption of the international simultaneous observations was favorably received by the merchant vessels coming into this port, and at present the principal vessels coming here are supplied with the blank forms, which they fill out as well as possible with the instruments they have on board.

The following summary shows the work done by the office for the year ending June 30, 1888:

	1887. July.	August.	September.	October.	November.	December.	1888. January.	February.	March.	April.	May.	June.	Total.
Vessels visited	38	33	43	87	66	88	67	51	63	33	28	29	[illegible]
Barometers compared or adjusted	31	22	36	72	59	75	63	35	40	40	25	22	[illegible]
Information to individuals	119	82	102	159	102	137	115	103	98	68	68	75	[illegible]
Chronometer comparisons given	12	10	11	14	6	7	11	5	1	3	5	1	[illegible]
Pilot Charts issued	115	96	114	127	142	195	148	108	118	14	100	121	[illegible]
Weekly supplement to Pilot Chart	117	164	117	195	156	133	156	156	195	99	156	195	[illegible]
Day marks of United States issued	24	27	32	41	33	50	59	20	23	8	...	37	[illegible]
Light-lists of United States issued	12	11	10	13	7	11	7	1	1	28	6	13	[illegible]
Extracts of Notice to Mariners	182	222	188	444	118	353	329	345	269	157	330	305	[illegible]
Cable charts issued	5	2	...	...	...	...	1	1	1	...	2	...	[illegible]
Hints on West India hurricanes	17	9	38	13	11	11	6	1	3	1	...	3	[illegible]
Pamphlets on the use of oil	2	8	16	11	8	12	5	2	3	4	...	3	[illegible]
Wrecks	2	2	2	10	10	7	3	...	5	3	2	3	[illegible]
Limits under Fishery treaty	...	...	...	...	...	...	...	...	...	3	2	...	[illegible]
Storms at sea	2	3	16	16	15	11	8	4	14	4	7	2	[illegible]
Whales	...	1	...	...	...	1	...	...	...	1	...	...	3
Buoys adrift	1	...	3	...	...	2	...	...	...	...	...	...	6
Water-spouts	1	...	...	...	1	...	1	...	...	...	...	...	5
Charts corrected	...	...	1	...	...	...	...	...	...	...	...	...	1
Trade-wind limits	2	1	...	5	9	4	6	3	2	...	...	1	33
Tidal wave	1	...	...	...	...	...	...	...	...	...	...	...	1
Abstract Pilot Chart	...	49	15	2	...	...	...	...	...	...	...	...	66
Current report	...	3	...	...	...	...	...	...	...	...	...	...	3
Valley Nile report	...	2	1	3	...	1	...	...	...	...	...	...	7
Reports of use of oil	...	...	2	3	1	...	2	1	1	...	...	...	10
Unusual phenomena	...	...	1	...	...	...	...	...	...	...	...	...	1
Track chart steam-ship *Caribbean*	...	...	2	...	1	1	...	...	...	...	1	...	5
Track chart steam-ship *Prince Frederic*	...	...	...	...	...	1	...	...	...	...	...	...	1
Track chart steam-ship *Ashfield*	...	...	...	...	...	...	1	...	...	...	...	...	1
Track charts forwarded	...	...	...	...	...	...	...	1	...	...	...	...	1
Reports of obstruction in channel	...	...	1	...	...	...	...	...	...	1	...	...	2
Chronometers rated	...	...	...	3	...	1	1	...	...	2	2	1	10
Submarine earthquakes	...	...	...	1	...	...	...	...	...	1	...	...	2
Sunken-rock report	...	...	...	1	...	...	...	...	...	...	...	...	1
Meteorological report	...	...	...	1	...	...	...	1	1	6	11	18	38
Shoal report	...	...	...	1	2	...	...	...	...	...	...	...	3
North Atlantic charts issued	...	...	...	12	...	...	...	...	...	...	...	...	12
North Pacific charts issued	...	...	...	...	...	1	...	...	...	...	...	...	1
Compass report	...	...	...	...	...	3	...	...	...	...	...	...	3
Hydrographer's annual report	...	...	...	...	...	15	...	...	...	...	...	...	15
Wave report	...	...	...	...	...	1	...	...	...	...	...	...	1
Extract log steam-ship *City of Lincoln*	...	...	...	...	...	1	...	...	...	...	...	...	1
Extract log steam-ship *Capulet*	...	...	...	...	...	1	...	...	...	...	...	...	1
Extract log steam-ship *Professor*	...	...	...	...	...	1	...	...	...	...	...	...	1
Extract log steam-ship *Red Sea*	...	...	...	...	...	1	...	...	...	...	...	...	1
Water-spout pamphlets	...	...	...	...	...	...	...	...	90	32	51	4	177
Monthly review, January	...	...	...	...	...	...	...	...	6	4	4	2	16
Light-house report	...	...	...	...	...	...	...	...	1	...	...	...	1
Monthly review, February	...	...	...	...	...	...	...	...	...	...	15	2	17
Submarine oil springs	...	...	1	1	...	...	1	...	...	1	...	...	4
General sailing charts	...	...	...	...	...	4	...	...	...	...	...	...	4
Monthly review, March	...	...	...	...	...	...	...	...	...	...	...	5	5

Respectfully submitted.

F. R. WALL,
Ensign, U. S. Navy.

Lieut. G. L. DYER, U. S. Navy,
Hydrographer.

U. S. BRANCH HYDROGRAPHIC OFFICE,
Merchants' Exchange, San Francisco, Cal., July 1, 1888.

SIR: I respectfully submit the following report of the work of this office for the year ending June 30, 1888:

The tabular statement shows considerable increase in many of the items over last year.

The regular work of the office has been kept up; charts, sailing directions, and light-lists have been corrected immediately upon the receipt of Notices to Mariners, and extracts from the latter have been supplied to all outward bound vessels. Vessels arriving from foreign ports, as well as a great many coasters, have been visited and their barometers compared and adjusted. Charts, light-lists, lists of buoys and beacons, and a great many pamphlets on subjects of interest and importance to sea-faring people have been distributed.

Meteorological journals have been distributed to those willing to keep them and the filled journals received at this office have been forwarded.

Time signals are still received from the naval observatory at Mare Island, every day at noon, and the time-ball managed by this office continues to work well. The Gardner clock kept in this office has, so far, worked without a single failure and is consulted daily by the business community of the city for correct time. A standard chronometer, compared daily with the time signal, affords opportunities to shipmasters to leave their chronometers and have them rated; owing, however, to the prominent position of the time-ball, many prefer to rate their own chronometers without moving them.

Owing to lack of funds, but two special bulletins have been issued since January 1, 1888.

The opportunity afforded to shipmasters to compare and correct their aids to navigation, although more generally taken advantage of, is still not improved to the extent that it should be; in the case of the *Henry James*, a vessel recently lost on the Kingman Reef, about 35 miles to northward of Palmyra Island, in the North Pacific, the court of inquiry decided that the loss of the vessel was due to the use of a chart (Imray, 1880) upon which the reef in question was not properly laid down.

Great interest is taken, by those interested or engaged in maritime pursuits, in the tracks of vessels trading to this port. I would suggest that if a number of copies of Hydrographic Office Chart No. 923, printed upon cheap paper, could be issued to this office, the tracks of all vessels making good passages to this port, as well as the position of reported wrecks and vessels spoken at sea, could be plotted and posted for the information of all interested.

The want of new and adequate sailing directions for the Pacific Ocean, and particularly for the islands of the South Pacific, is greatly felt.

Accompanying is a tabular statement of the work of the office for the year:

	1887.						1888.						
	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Storm reports forwarded					1	75	1	1	1				[illegible]
Trade-limit reports	20	23	14	66	19	45	36	46	19	13	8	23	[illegible]
Abstracts of logs forwarded				2	1	1	1	16	4	1	9	7	[illegible]
Wrecks reported	1						10	7	5	1			[illegible]
Earthquake reports	2								1				[illegible]
Buoys adrift							8	7	2	1	2		[illegible]
General information given	2	10	2	2	1	7	9	4	4	6	1	10	[illegible]
Vessels visited	85	90	79	99	78	108	107	107	155	89	69	59	1,[illegible]
Information furnished to individuals	90	86	79	968	187	166	240	237	225	176	196	173	2,[illegible]
Barometers compared or adjusted	44	21	31	53	36	73	70	57	72	44	28	21	[illegible]
Charts corrected					1	2		41	15	21	3		[illegible]
Pilot Charts distributed	8	8	8	8	8	16	13	24	12	12	15	12	[illegible]
Notices to Mariners distributed	1,263	932	545	1,053	1,477	1,433	1,931	1,716	1,480	1,274	1,417	1,479	16,0[illegible]
Meteorological journals issued	3	6	3	5	3	6		1					[illegible]
Meteorological journals returned filled	2	1	6		4	4	9	3	3		2	2	36
Meteorological journals returned unfilled		1											1
Meteorological charts distributed	1		3										4
Light lists distributed		12	3	9	2	3					39	111	179
Light lists 1, 2, 3, 4, 5, 6 distributed	Each 1	2											[illegible]
Day-marks distributed		28	2		21	120	279	167	375	227	90	18	1,[illegible]
Chronometers rated		2	1	2	4	1		1	4	1	2	2	20
Hydrographic Office Charts distributed	5	2			4	48		19	11	6			95
Light lists corrected					18	1		4	2	1			26
Greely charts distributed						20							20
Submarine cable charts distributed	25	35	4				10	4	2	2	12	4	
Pamphlets on use of oil distributed	31		1		14	1	25	3	38	16	10	1	14[illegible]
Reports of unusual phenomena:													
Special bulletins distributed									400			400	800
Hydrographer's report distributed						20				3			23
Ice reports forwarded		2					1						3
Greenwich noon observations issued						50	34	16		18	13	13	14[illegible]
Fog reports forwarded						43							43
Thermometers compared		2	1		1				1				5
Hurricane pamphlets distributed			40										40
Greenwich noon observations returned filled									1	2	8		11
Waterspout circulars issued										63	25		
Fishery limits charts distributed										10			10
Waterspout reports distributed										65	25	11	
Magnetic variation charts issued									49	1			50
Monthly weather reports issued									25	24	23	18	90
Storm journals issued	26												26
Instructions to captains									7		3	3	13
Reports on submarine oil springs								5	1				6

Respectfully submitted.

H. P. McIntosh,
Lieutenant, U. S. Navy.

Lieut. G. L. Dyer, U. S. Navy,
Hydrographer.

THE 9.6-INCH EQUATORIAL.

(Professor Frisby, in charge.)

ıis instrument has been used for the identification of stars in the re- ›n of Yarnall's Catalogue, and in observations of small planets, ets, and of occultations of stars by the moon. Three comets have ı seen during the year, and thirty-five observations made, all of ıich, as far as reduced, have been published in the Astronomical Jour- .l. Nine observations of occultations of stars by the moon and a few :vations of minor planets have been made. Two evenings in each ›eк have been set apart for the accommodation of visitors.

All the work of revision of Yarnall's Catalogue is substantially com- ›d, and the main part of the printing done; the notes are nearly y for the press, and it is believed that the whole work will soon be ished.

CHRONOMETERS AND TIME SERVICE.

(Lieutenant Paine in charge until April 23; since then Ensign Mayer.)

Chronometers have been received, issued, cleaned, condemned, and purchased during the year as follows:

	Received from service.	Issued.	Cleaned.	Condemned.	Purchased.
Box chronometers	36	39	48	9	14
Hack chronometers	8	9	5	....	....

The following is the disposition of the chronometers belonging to the Navy:

	Issued.	On trial.	Under repairs.	Awaiting repairs.	Loaned.	Ready for issue.
Box chronometers	150	20	42	21	3	42
Hack chronometers	70	....	2	133	3	5
Pocket chronometers	1	....	....	5	....	1
Pocket-hack chronometers	2	....	....	4	....	....
Comparing watches	....	....	....	4	....	....

Of those classed as issued, 25 box, 9 "hack," and 2 "pocket-hacks" e at the branch observatory at Mare Island.

The temperature room was in use from the 1st of January to the 16th March, for the trial of thirty box chronometers submitted to com- tition. At the same time there were placed on trial twenty-four box one pocket instrument, belonging to the Navy which had recently en repaired and regulated. The trial was conducted in the same ıner as was the preceding one, except that the hygrometric test was ıtted. Of those submitted for competition, fourteen were recom- 'nded for purchase. The results of the trial will be found recorded ın the accompanying appendixes A and B.

The alterations in the temperature room, to which allusion was made the last report, have so increased its efficiency that it will in future practicable to begin the trials at an earlier date.

The chronometers that are now being returned to the Ol a from ships going out of commission were issued with rate-curve Upon some of these sheets the records have been continued, but instances they are either incomplete or entirely neglected. As records are not only important and interesting histories of the formance of chronometers, but also valuable to makers when ments are placed in their hands for repairs, it is desirable tl should be kept up with systematic regularity. It is therefore n mended that the attention of commanding and navigating office called to the importance of so keeping them.

The Observatory continues to send daily over the wires of the W Union Telegraph Company the time-signal at noon of the sevent meridian. By it time-balls are dropped at Newport, R. I., Wood's New York, Philadelphia, Baltimore, Washington, Hampton Roads, vannah, and New Orleans. The signal is also sent over the lines of number of railroads, and their time-pieces are regulated by it.

On the Observatory clock line in this city there are 347 Gardner principally in Government buildings, which are automatically corr by the daily noon signal.

EAST TRANSIT INSTRUMENT.

(Lieutenant Heilner, in charge.)

The condition of this instrument is good. All the clocks are perfo well. Daily observations, when practicable, were made for the co tion of the standard mean-time clock.

EXAMINATION OF INSTRUMENTS.

This division has been under the general supervision of t superintendent, Commander Allan D. Brown, whose report is marked C.

MAGNETIC INSTRUMENTS.

(Lieutenant Elliott, in charge.)

Observations of absolute declination have been made twice the practice being to observe at 10 a. m. and 3 p. m. Fr propriately grouped, the value of the photographed l s o declination magnetograms is deduced. The performan of the declination magnet and theodolite is good, and the resul to be within a close limit of correctness.

An observation or experiment for the determination of th horizontal intensity is made Tuesday of each week. A t n bration experiments, with inertia cylinder in place, have en for the verification of the value of K found at Kew obs in The magnets used in these experiments and the instrum e in lent condition. The forms are so arranged that the computa sults at the end of the year or series is only a few hours' wo

Three needles have been used in observations of incli ion the year, the practice being to use each needle once a week.

The performance of the declination and horizontal f ce graphs has been excellent. They were re-adjusted t g the year and scale values redetermined with the fou

Declination.—One centimeter of ordinate = 11′.29 arc.

izontal force.—One centimeter of ordinate = .0008 c. g. s. units.
vertical force magnetograph has been at no time in satisfactory ment. A serious chipping of the agate knife-edge was discov- and a new agate has been ordered. It is hoped that when the new arrives this delicate instrument can be successfully adjusted.
computation, tabulation, and general record of observations have kept up, as far as compatible with the scheme of the work.

THE LIBRARY.

library now contains over 12,000 volumes and 2,600 pamphlets. ccessions during the year have been 513—459 volumes and 54 ts. Of these, 288 were received in exchange and 225 were

of a librarian has been greatly felt the past year; and the indexer and copyist (for which estimates have been sub- e very much needed.

THE CENTENNIAL EXPOSITION AT CINCINNATI.

Observatory exhibit, a detailed report of which will be made at ose of the exposition, is a very creditable one. A marked feature exhibit is the time-ball dropped daily, by signal from the Observ- from a staff on the main building. The apparatus for its ma- tion was set up and adjusted by Mr. William F. Gardner, the tor, to whom is due all the credit for its successful performance.

INTERNATIONAL ASTROPHOTOGRAPHIC CONGRESS.

mentioned in the last report, Lieut. A. G. Winterhalter was de- by the Department as the representative of the Observatory at nternational Astrophotographic Congress, held at Paris in April, After the adjournment of the congress Lieutenant Winterhalter, der of the Department, visited the principal observatories and ablishments of a scientific character in England, France, Ger- ustria, Holland and Italy. Since his return to the United n November last, he has been actively engaged in the prepara- s report, which is now nearly completed.

THE NEW NAVAL OBSERVATORY.

contract for the erection of the nine buildings comprising the vatory, awarded to Messrs. P. H. McLaughlin & Co., of Wash- D. C., having been executed, the work upon them will be com- once.
nt already appropriated will be sufficient to make the par- nts called for in the contract until the end of the second ses- present Congress. It is not sufficient, however, to admit of s being made for the domes until further appropriations shall

CONNECTION WITH WASHBURN OBSERVATORY.

resolutions of the board of regents of the University of Wiscon- ansmitted to the Department through President T. C. Chamberlin, e use of the Washburn Observatory during the removal of the Observatory was tendered.

Co-ordination of work between the two observatories was invi the same authorities and cordially accepted. Prof. Asaph senior astronomer at this observatory, was, with the consent o partment, appointed consulting director of the Washburn O which office he now holds, and Prof. S. J. Brown was detailed there.

MISCELLANEOUS.

A record of the state of the "seeing" has been kept by the men, from which it appears that on 174 nights it was cloudy, the seeing was poor, on 63 it was fair, on 12 it was good, and on very good.

The names of 1,764 visitors have been recorded during the 1,499 permits for night visitors have been issued.

The report of Prof. William Harkness of the progress of the Transit-of-Venus Commission is herewith forwarded, marked dix D.

Appendix E is a letter from Lieutenant Winterhalter, preliminary his report, to which allusion has been made.

I invite the attention of the Bureau to his recommendations tha vision be made to enable this Observatory to do the work which to its share in charting the sky by photographic processes. P estimates will be submitted as soon as they can be prepared.

Very respectfully,

R. L. PHYTHIAN,
Captain, U. S. Navy, Superintendent.

The CHIEF OF THE BUREAU OF NAVIGATION,
Navy Department.

[In temperature room from January 4 to March 16; after that in chronometer room.]

				Jan. 4 to Jan. 11	Jan. 12 to Jan. 19	Jan. 20 to Jan. 27	Jan. 29 to Feb. 5	Feb. 6 to Feb. 13	Feb. 14 to Feb. 21	Feb. 22 to Feb. 29	Mar. 1 to Mar. 8	Mar. 9 to Mar. 16	Mar. 16 to Mar. 23	Mar. 23 to Mar. 30	Mar. 30 to Apr. 6	Apr. 6 to Apr. 13	Apr. 13 to Apr. 20	Apr. 20 to Apr. 27
Time				Jan. 4 to Jan. 11	Jan. 12 to Jan. 19	Jan. 20 to Jan. 27	Jan. 29 to Feb. 5	Feb. 6 to Feb. 13	Feb. 14 to Feb. 21	Feb. 22 to Feb. 29	Mar. 1 to Mar. 8	Mar. 9 to Mar. 16	Mar. 16 to Mar. 23	Mar. 23 to Mar. 30	Mar. 30 to Apr. 6	Apr. 6 to Apr. 13	Apr. 13 to Apr. 20	Apr. 20 to Apr. 27
Temperature, Fahrenheit				44°.87	55° 02	70°.04	85°.01	90°.01	85°.02	69°.93	54°.95	44°.90	51°.93	52°.75	65°.85	65°.53	63°.08	61°.75
Relative humidity, per cent				69.5	68.5	70.7	69.5	70.0	70.0	68.6	67.6	67.7	60.0	64.6	63.5	58.0	58.0	52.0
	Chronometer maker.	*No.*	*Description of balance, given by maker.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*
1	T. S. & J. D. Negus	1775	Ordinary balance, with Negus correction.	−2.636	−2.380	−2.061	−2.487	−2.567	−2.194	−1.994	−2.051	−1.997	−1.719	−1.704	−1.279	−1.333	−1.337	−1.256
2	....do	1748	Flat-rim balance	+0.543	−0.023	−0.204	−0.094	−0.067	−0.301	−0.494	−0.409	−0.140	−0.183	−0.311	−0.529	−0.726	−0.659	−0.613
3	....do	1767	Ordinary balance, with Negus correction.	−1.636	−1.451	−1.633	−1.809	−1.889	−1.730	−1.494	−1.837	−1.783	−1.469	−1.490	−0.921	−0.797	−0.694	−0.577
4	Wm. Bond & Son	529	Hartnup balance	−0.171	+0.441	+0.439	−0.344	−0.781	−0.551	+0.077	−0.123	−0.461	−0.040	−0.061	+0.257	+0.167	+0.270	+0.280
5	T. S. & J. D. Negus	1723	Ordinary balance, with Negus correction.	+0.864	+0.513	+0.939	+0.763	+0.754	+0.770	+0.720	+0.484	+1.074	+1.103	+0.974	+1.079	+1.024	+1.163	+1.459
6	....do	1768	......do	−1.814	−1.130	−0.669	−1.701	−2.031	−1.659	−0.816	−0.801	−1.140	−0.683	−0.704	0.493	−0.440	−0.409	−0.256
7	Wm. Bond & Son	520	Plain balance	−2.529	−1.273	−0.919	−1.880	−2.353	−2.230	−1.244	−1.587	−2.533	−1.254	−1.311	−0.814	−1.011	−0.944	−0.863
8	T. S. & J. D. Negus	1773	Ordinary balance, with Negus correction.	−1.064	−1.201	−0.990	−0.880	−0.746	−0.469	−0.280	−0.373	−0.497	−0.290	−0.347	+0.293	+0.310	+0.234	+0.280
9	H. H. Heinrich	811	Ordinary balance, with Heinrich's auxiliary.	−0.064	+0.906	+0.653	+0.084	+0.076	−0.087	+0.291	+0.020	−0.140	+0.317	+0.474	+0.864	+0.917	+0.734	+0.744
10	T. S. & J. D. Negus	1721	Ordinary balance	−2.064	−1.059	−0.669	−1.737	−2.389	−1.944	−1.244	−1.730	−2.211	−1.897	−1.954	−1.136	−1.154	−1.123	−1.041
11	....do	1762	......do	−3.029	−1.737	−0.847	−1.666	−2.424	−1.766	−1.030	−1.944	−2.961	−1.933	−1.883	−1.064	−1.119	−1.016	−0.899
12	Wm. Bond & Son	514	Hartnup balance	−1.564	−1.987	−2.419	−3.416	−3.103	−2.587	−2.030	−1.801	−2.176	−1.897	−2.061	−1.743	−1.654	−1.337	−1.041
13	John Bliss & Co	2809	Ordinary balance	−1.564	−0.591	+0.260	−0.844	−1.317	−0.873	+0.326	−0.587	−2.319	−1.183	−0.883	+0.221	+0.346	+0.413	+0.244
14	T. S. & J. D. Negus	1739	......do	−3.421	−1.666	−0.240	−0.451	−0.889	−0.650	−0.316	−1.873	−3.819	−2.326	−2.097	−0.529	−0.619	−0.266	−0.399
15	H. H. Heinrich	3458	Ordinary bal., with Heinrich's auxiliary palladium spring.	−1.421	−1.559	−1.276	−0.309	−0.281	−0.909	−1.101	−2.159	−1.997	−2.004	−1.847	−1.564	−1.797	−1.587	−1.541
16	Wm. Bond & Son	501	Plain balance	−1.564	−0.273	+1.010	−0.094	−0.139	+0.127	+0.970	+0.520	−0.854	+0.496	+0.439	+1.614	+1.310	+1.234	+1.494
17	T. S. & J. D. Negus	1765	Ordinary balance, with Negus correction.	−2.921	−1.951	−1.847	−2.987	−3.460	−2.909	−1.959	−1.516	−2.604	−1.826	−1.883	−0.779	−0.761	−0.944	−0.934
18	John Bliss & Co	2818	Bliss auxiliary balance	−1.493	−0.380	+0.72[illegible]	+0.013	−0.389	−0.337	+0.684	+0.627	−0.533	+0.210	+0.153	+0.579	+0.810	+1.449	+1.566
19	Wm. Bond & Son	482	Plain balance	−1.029	−0.059	+0.4[illegible]3	−0.916	−1.924	−1.516	−0.637	−0.730	−0.783	−0.754	−0.454	−0.243	−0.119	−0.194	−0.256
20	John Bliss & Co	2810	Bliss auxiliary balance	−0.243	+0.763	+0.546	−0.023	+0.433	+0.413	+0.756	+1.341	+0.539	+1.139	+0.974	+1.186	+1.024	+1.413	+1.387
21	T. S. & J. D. Negus	1774	Ordinary balance, with Negus correction.	−2.064	−1.987	−1.740	−1.630	−1.603	−1.087	−1.030	−0.801	−0.247	−0.326	−0.669	−0.707	−0.440	−0.230	−0.113
22	....do	1776	......do	−1.386	−1.630	−1.007	−1.451	−1.710	−1.087	−0.423	−0.480	−0.283	−0.290	−0.419	−0.171	−0.011	+0.234	+0.280
23	John Bliss & Co	2851	Ordinary balance	−2.243	−0.130	+1.296	+0.727	+0.111	+0.841	+1.613	+0.690	−1.104	+0.424	+0.403	+2.043	+2.060	+2.199	+2.173

APPENDIX A.—*Record of competitive trial of chronometers, January, 1888–July, 1888*—Continued.

Time				Jan. 4 to Jan. 11	Jan. 12 to Jan. 19	Jan. 20 to Jan. 27	Jan. 29 to Feb. 5	Feb. 6 to Feb. 13	Feb. 14 to Feb. 21	Feb. 22 to Feb. 29	Mar. 1 to Mar. 8	Mar. 9 to Mar. 16	Mar. 16 to Mar. 23	Mar. 23 to Mar. 30	Mar. 30 to Apr. 6	Apr. 6 to Apr. 13	Apr. 13 to Apr. 20	Apr. 20 to Apr. 27
Temperature, Fahrenheit				44°.87	55°.02	70°.04	85°.01	90°.01	85°.02	69°.93	54°.95	44°.90	51°.93	52°.75	65°.85	65°.53	63°.08	61°.75
Relative humidity, per cent				69.5	68.5	70.7	69.5	70.0	70.0	68.6	67.6	67.7	60.0	64.6	63.5	58.0	58.0	52.0
	Chronometer maker—Continued.	*No.*	*Description of balance, given by maker*—Continued.	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*
24	John Bliss & Co	2852	Ordinary balance	−3.529	−1.916	−0.347	−0.594	−0.817	−0.016	+0.256	−0.909	−2.211	−1.040	−0.740	+0.829	+0.810	+0.806	+0.744
25	Wm. Bond & Son	480	Plain balance	+0.364	+1.013	+0.046	−2.094	−2.996	−2.301	−0.709	−0.266	−0.604	−0.147	−0.383	−0.100	−0.069	+0.127	+0.209
26	John Bliss & Co	2813	Bliss auxiliary balance	+0.007	+1.513	+1.831	+1.656	+3.647	+1.663	+2.756	+1.806	+0.753	+1.531	+1.367	+2.007	+1.953	+1.984	+2.030
27	..do	2853	Ordinary balance	−2.100	−0.773	+0.724	+1.013	+0.647	+1.306	+1.756	+0.984	+0.039	+1.281	+1.260	+2.436	+2.560	+2.449	+2.601
28	..do	2792	Auxiliary balance	+1.471	+1.906	+1.010	+1.584	+1.397	+1.484	+0.863	+2.020	+1.610	+2.246	+2.296	+1.543	+1.381	+1.699	+1.887
29	..do	2827	Ordinary balance	−0.850	+0.656	+2.296	+1.477	+1.326	+2.020	+2.970	+2.127	+0.717	+2.674	+2.617	+4.221	+4.167	+4.199	+4.387
30	..do	2829	..do	−2.171	−1.059	+0.939	+1.299	+1.540	+2.127	+2.827	+1.556	−0.176	+1.174	+1.224	+1.900	+2.703	+3.199	+3.137

[In temperature room from January 4 to March 16; after that in chronometer room.]

				Apr. 27 to May 4	May 4 to May 11	May 11 to May 18	May 18 to May 25	May 25 to June 1	June 1 to June 8	June 8 to Ju'e 15	Ju'e 15 to Ju'e 22	Ju'e 22 to Ju'e 29	Ju'e 29 to July 6	Temperature of compensation.	Temperature constant.	First trial number.	Final trial number.
Time																	
Temperature, Fahrenheit				71°.15	73°.17	71°.04	67°.66	75°.18	73°.15	75°.53	82°.09	83°.56	74°.95				
Relative humidity, per cent				58.0	62.7	60.5	62.8	70.1	66.6	68.0	66.7	66.8	62.0				
	Chronometer maker.	*No.*	*Description of balance, given by maker.*	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	°	s.	s.	s.
1	T. S. & J. D. Negus	1775	Ordinary balance, with Negus correction.	−1.041	−1.021	−1.083	−0.837	−0.890	−0.921	−0.847	−0.816	−0.919	−0.831	68.129	−0.00111	4.8059	6.3188
2	......do	1748	Flat-rim balance	−0.684	−0.271	−0.369	−0.337	+0.039	+0.186	+0.081	+0.149	+0.010	+0.133	69.500	+0.000633	3.8825	6.6381
3	......do	1767	Ordinary balance, with Negus correction.	−0.434	−0.343	−0.440	−0.230	−0.354	−0.386	−0.276	−0.566	−0.597	−0.403	66.733	−0.000643	2.4891	6.6507
4	Wm. Bond & Son	529	Hartnup balance	+0.316	+0.306	+0.167	+0.449	+0.396	+0.436	+0.439	+0.184	+0.010	+0.383	64.347	−0.00179	9.2838	10.3242
5	T. S. & J. D. Negus	1723	Ordinary balance, with Negus correction.	+1.030	+0.907	+0.703	+0.949	+0.896	+0.686	+0.760	+0.970	+0.974	+0.776	75.102	−0.000875	10.6658	13.2902
6	......do	1768	......do	−0.29[illegible]	−0.343	−0.476	−0.230	−0.390	−0.243	−0.169	−0.741	−0.740	−0.046	65.381	−0.00258	12.3659	13.4268
7	Wm. Bond & Son	520	Plain balance	−0.684	−0.521	−0.869	−0.337	−0.997	−1.350	−1.383	−1.601	−1.883	−1.331	66.475	−0.00293	13.4033	16.4309
8	T. S. & J. D. Negus	1773	Ordinary balance, with Negus correction.	+0.709	+0.801	+0.753	+0.734	+0.824	+0.757	+0.939	+0.970	+0.867	+0.990	76.662	−0.000356	12.3121	16.6802
9	H. H. Heinrich	811	Ordinary balance, with Heinrich's auxiliary.	+1.173	+1.407	+1.274	+1.091	+1.074	+1.257	+1.189	+1.149	+1.010	+0.740	62.780	−0.00107	11.6065	16.7141
10	T. S. & J. D. Negus	1721	Ordinary balance	−0.79[illegible]	−0.629	−0.761	−0.480	−0.640	−0.671	−0.704	−1.101	−1.276	−0.724	67.470	−0.00294	16.4786	18.2742
11	......do	1762	......do	−1.041	−0.807	−0.940	−0.730	−0.747	−0.707	−0.669	−1.066	−1.204	−0.724	70.553	−0.00373	17.4764	19.2989
12	Wm. Bond & Son	514	Hartnup balance	−1.256	−1.020	−1.083	−0.944	−0.640	−0.779	−0.454	−0.744	−0.811	−0.367	51.426	−0.000993	12.8261	23.8485
13	John Bliss & Co	2809	Ordinary balance	+0.351	+0.407	+0.239	+0.377	+0.039	+0.293	+0.189	−0.351	−0.454	+0.204	69.012	−0.00452	23.8026	24.4915
14	T. S. & J. D. Negus	1739	......do	−0.041	+0.014	−0.190	−0.159	+0.074	+0.114	−0.240	−0.244	−0.347	−0.367	73.150	−0.00393	22.8828	25.9804
15	H. H. Heinrich	3458	Ordinary bal., with Heinrich's auxiliary palladium spring.	−1.863	−1.557	−1.083	−1.123	−1.461	−1.636	−1.490	−1.851	−2.276	−2.117	171.902	−0.000504	16.7277	26.0913
16	Wm. Bond & Son	501	Plain balance	+1.637	+1.729	+1.596	+1.663	+1.289	+1.543	+1.331	+0.791	+1.010	+1.490	69.564	−0.00409	24.9137	26.1681
17	T. S. & J. D. Negus	1765	Ordinary balance, with Negus correction.	−0.756	−0.843	−1.011	−0.587	−1.211	−1.171	−1.204	−1.709	−1.919	−1.296	59.586	−0.00195	15.2523	27.3627
18	John Bliss & Co	2818	Bliss auxiliary balance	+1.137	+1.336	+1.060	+1.306	+1.003	+1.114	+1.046	+0.720	+0.581	+1.526	68.523	−0.00321	21.7527	27.9031
19	Wm. Bond & Son	482	Plain balance	−0.184	−0.093	−0.369	−0.194	−0.211	−0.100	−0.133	−0.494	−0.069	−0.224	65.520	−0.00306	27.8888	29.1884
20	John Bliss & Co	2810	Bliss auxiliary balance	+0.851	+0.761	+0.810	+1.091	+0.646	+0.579	+0.689	+0.756	+0.831	+0.740	46.863	−0.000122	26.0661	29.3785
21	T. S. & J. D. Negus	1774	Ordinary balance, with Negus correction.	+0.030	+0.229	+0.203	+0.377	+0.324	+0.436	+0.546	+0.506	+0.474	+0.776	55.000	+0.00004	25.0864	29.4128
22	......do	1776	......do	+0.173	+0.121	+0.167	+0.413	+0.289	+0.364	+0.439	+0.327	+0.260	+0.669	68.004	−0.00178	27.3121	29.5322
23	John Bliss & Co	2851	Ordinary balance	+2.816	+3.014	+2.953	+3.056	+3.360	+3.364	+3.474	+3.113	+2.831	+3.526	72.038	−0.00409	29.1727	34.0568

APPENDIX A.—*Record of competitive trial of chronometers, January, 1888–July, 1888*—Continued.

	Time			Jan. 4 to Jan. 11	Jan. 12 to Jan. 19	Jan. 20 to Jan. 27	Jan. 29 to Feb. 5	Feb. 6 to Feb. 13	Feb. 14 to Feb. 21	Feb. 22 to Feb. 29	Mar. 1 to Mar. 8	Mar. 9 to Mar. 16	Mar. 16 to Mar. 23	Mar. 23 to Mar. 30	Mar. 30 to Apr. 6	Apr. 6 to Apr. 13	Apr. 13 to Apr. 20	Apr. 20 to Apr. 27
	Temperature, Fahrenheit			44°.87	55°.02	70°.04	85°.01	90°.01	85°.02	69°.93	54°.95	44°.90	51°.93	52°.75	65°.85	65°.53	63°.08	61°.75
	Relative humidity, per cent			69.5	68.5	70.7	69.5	70.0	70.0	68.6	67.6	67.7	60.0	64.6	63.5	58.0	58.0	52.0
	Chronometer maker—Continued.	*No.*	*Description of balance, given by maker*—Continued.	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*
24	John Bliss & Co	2852	Ordinary balance	−3.529	−1.916	−0.347	−0.594	−0.817	−0.016	+0.256	−0.909	−2.211	−1.040	−0.740	+0.829	+0.810	+0.806	+0.744
25	Wm. Bond & Son	480	Plain balance	+0.364	+1.013	+0.046	−2.094	−2.996	−2.301	−0.709	−0.266	−0.604	−0.147	−0.383	−0.100	−0.069	+0.127	+0.209
26	John Bliss & Co	2813	Bliss auxiliary balance	+0.007	+1.513	+1.831	+1.656	+3.647	+1.663	+2.756	+1.806	+0.753	+1.531	+1.367	+2.007	+1.953	+1.984	+2.030
27	do	2853	Ordinary balance	−2.100	−0.773	+0.724	+1.013	+0.647	+1.306	+1.756	+0.984	+0.039	+1.281	+1.260	+2.436	+2.560	+2.449	+2.601
28	do	2792	Auxiliary balance	+1.471	+1.906	+1.010	+1.584	+1.397	+1.484	+0.863	+2.020	+1.610	+2.246	+2.296	+1.543	+1.381	+1.699	+1.887
29	do	2827	Ordinary balance	−0.850	+0.656	+2.296	+1.477	+1.326	+2.020	+2.970	+2.127	+0.717	+2.674	+2.617	+4.221	+4.167	+4.199	+4.387
30	do	2829	do	−2.171	−1.059	+0.939	+1.299	+1.540	+2.127	+2.827	+1.556	−0.176	+1.174	+1.224	+1.900	+2.703	+3.199	+3.137

APPENDIX A.—*Record of competitive trial of chronometers, January, 1888–July, 1888*—Continue

[In temperature room from January 4 to March 16; after that in chronometer room.]

				Apr. 27 to May 4	May 4 to May 11	May 11 to May 18	May 18 to May 25	May 25 to June 1	June 1 to June 8	June 8 to Ju'e 15	Ju'e 15 to Ju'e 22	Ju'e 22 to Ju'e 29	Ju'e 29 to July 6	Temperature of compensation.	Temperature constant.	First trial number.	Final trial number.
	Time																
	Temperature, Fahrenheit			71°. 15	73°. 17	71°. 04	67°. 66	75°. 18	73°. 15	75°. 53	82°. 09	83°. 56	74°. 95				
	Relative humidity, per cent			58. 0	62. 7	60. 5	62. 8	70. 1	66. 6	68. 0	66. 7	66. 8	62. 0				
	Chronometer maker.	*No.*	*Description of balance, given by maker.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	°	*s.*	*s.*	*s.*
1	T. S. & J. D. Negus	1775	Ordinary balance, with Negus correction.	−1. 041	−1. 021	−1. 083	−0. 837	−0. 890	−0. 921	−0. 847	−0. 816	−0 919	−0. 831	68. 129	−0. 00111	4. 8059	6. 3188
2	......do	1748	Flat-rim balance	−0. 684	−0. 271	−0. 369	−0. 337	+0. 039	+0. 186	+0. 081	+0. 149	+0. 010	+0. 133	69. 500	+0. 000633	3. 8825	6. 6381
3	......do	1767	Ordinary balance, with Negus correction.	−0. 434	−0. 343	−0. 440	−0. 230	−0. 354	−0. 386	−0. 276	−0. 566	−0. 597	−0. 403	66. 733	−0. 000643	2. 4891	6. 6507
4	Wm. Bond & Son	529	Hartnup balance	+0. 316	+0. 300	+0. 167	+0. 449	+0. 396	+0. 436	+0. 439	+0. 184	+0. 010	+0. 383	64. 347	−0. 00179	9. 2838	10. 3242
5	T. S. & J. D. Negus	1723	Ordinary balance, with Negus correction.	+1. 030	+0. 907	+0. 703	+0. 949	+0. 896	+0 686	+0. 760	+0. 970	+0. 974	+0. 776	75. 102	−0. 000875	10. 6658	13. 2902
6	......do	1768	......do	−0. 291	−0. 343	−0. 476	−0. 230	−0. 390	−0. 243	−0. 169	−0. 744	−0. 740	−0. 046	65. 381	−0. 00258	12. 3659	13. 4268
7	Wm. Bond & Son	520	Plain balance	−0. 684	−0. 521	−0. 869	−0. 337	−0. 997	−1. 350	−1. 383	−1. 601	−1. 883	−1. 331	66. 475	−0. 00293	13. 4033	16. 4309
8	T. S. & J. D. Negus	1773	Ordinary balance, with Negus correction.	+0. 709	+0. 801	+0. 705	+0. 734	+0. 824	+0. 757	+0. 939	+0. 970	+0. 867	+0. 990	76. 662	−0. 000356	12. 3121	16. 6802
9	H. H. Heinrich	811	Ordinary balance, with Heinrich's auxiliary.	+1. 173	+1. 407	+1. 274	+1. 091	+1. 074	+1. 257	+1. 189	+1. 149	+1. 010	+0. 740	62. 780	−0. 00107	11. 6065	16. 7141
10	T. S. & J. D. Negus	1721	Ordinary balance	−0. 791	−0. 629	−0. 761	−0. 480	−0. 640	−0. 671	−0. 704	−1. 101	−1. 276	−0. 724	67. 470	−0. 00294	16. 4786	18. 2742
11	......do	1762	......do	−1. 041	−0. 807	−0. 940	−0. 730	−0. 747	−0. 707	−0. 669	−1. 066	−1. 204	−0. 724	70. 553	−0. 00373	17. 4764	19. 2989
12	Wm. Bond & Son	514	Hartnup balance	−1. 256	−1. 020	−1. 083	−0. 944	−0. 640	−0. 779	−0. 454	−0. 744	−0. 811	−0. 367	51. 426	−0. 000993	12. 8261	23. 8485
13	John Bliss & Co	2809	Ordinary balance	+0. 351	+0. 407	+0. 239	+0. 377	+0. 039	+0. 293	+0. 189	−0. 351	−0. 454	+0. 204	69. 012	−0. 00452	23. 8026	24. 4915
14	T. S. & J. D. Negus	1739	......do	−0. 041	+0. 014	−0. 190	−0. 159	+0. 074	+0. 114	−0. 240	−0. 244	−0. 347	−0. 367	73. 150	−0. 00393	22. 8828	25. 9804
15	H. H. Heinrich	3458	Ordinary bal., with Heinrich's auxiliary palladium spring.	−1. 863	−1. 557	−1. 083	−1. 123	−1. 461	−1. 636	−1. 490	−1. 851	−2. 276	−2. 117	171. 902	−0. 000101	16. 7277	26. 0913
16	Wm. Bond & Son	501	Plain balance	+1. 637	+1. 729	+1. 596	+1. 663	+1. 289	+1. 543	+1. 331	+0. 791	+1. 010	+1. 490	69. 564	−0. 00409	24. 9137	26. 1681
17	T. S. & J. D. Negus	1765	Ordinary balance, with Negus correction.	−0. 756	−0. 843	−1. 011	−0. 587	−1. 211	−1. 171	−1. 204	−1. 709	−1. 919	−1. 296	59. 586	−0. 00195	15. 2523	27. 3627
18	John Bliss & Co	2818	Bliss auxiliary balance	+1. 137	+1. 336	+1. 060	+1. 306	+1. 003	+1. 114	+1. 046	+0. 720	+0. 581	+1. 526	68. 523	−0. 00321	21. 7527	27. 9031
19	Wm. Bond & Son	482	Plain balance	−0. 184	−0. 093	−0. 369	−0. 194	−0. 211	−0. 100	−0. 133	−0. 494	−0. 069	−0. 224	65. 520	−0. 00306	27. 8888	29. 1884
20	John Bliss & Co	2810	Bliss auxiliary balance	+0. 851	+0. 764	+0. 810	+1. 091	+0. 646	+0. 579	+0. 689	+0. 756	+0. 831	+0. 740	−46. 863	−0. 000122	26. 0661	29. 3785
21	T. S. & J. D. Negus	1774	Ordinary balance, with Negus correction.	+0. 030	+0. 229	+0. 203	+0. 377	+0. 324	+0. 436	+0. 546	+0. 506	+0. 474	+0. 776	55. 000	+0. 00004	25. 0864	29. 4128
22	......do	1776	......do	+0. 173	+0. 121	+0. 167	+0. 413	+0. 289	+0. 364	+0. 439	+0. 327	+0. 260	+0. 669	68. 004	−0. 00178	27. 3121	29. 5322
23	John Bliss & Co	2851	Ordinary balance	+2. 816	+3. 014	+2. 953	+3. 056	+3. 360	+3. 364	+3. 474	+3. 113	+2. 831	+3. 526	72. 038	−0. 00409	29. 1727	34. 0568

APPENDIX A.—*Record of competitive trial of chronometers, January, 1888–July, 1888*—Continued.

Time				Apr. 27 to May 4	May 4 to May 11	May 11 to May 18	May 18 to May 25	May 25 to June 1	June 1 to June 8	June 8 to Ju'e 15	Ju'e 15 to Ju'e 22	Ju'e 22 to Ju'e 29	Ju'e 29 to July 6	Temperature of compensation.	Temperature constant.	First trial number.	Final trial number.
Temperature, Fahrenheit				71°.15	73°.17	71°.04	67°.66	75°.18	73°.15	75°.53	82°.09	83°.56	74°.95				
Relative humidity, per cent				58.0	62.7	60.5	62.8	70.1	66.6	68.0	66.7	66.8	62.0				
	Chronometer maker—Continued.	*No.*	*Description of balance given by maker*—Continued.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	°	s.	s.	s.
24	John Bliss & Co	2852	Ordinary balance	+1.530	+1.943	+1.953	+2.020	+2.253	+2.364	+2.439	+2.424	+2.296	+2.526	75.103	−0.00362	36.8160	41.1015
25	Wm. Bond & Son	480	Plain balance	−0.149	−0.164	−0.190	+0.270	−0.247	−0.136	−0.276	−0.887	−1.133	−0.169	53.004	−0.00247	35.4933	43.7302
26	John Bliss & Co	2813	Bliss auxiliary balance	+2.173	+2.229	+2.167	+2.270	+2.181	+2.329	+2.331	+2.041	+1.939	+2.210	70.000	−0.00282	46.3169	47.2194
27	......do	2853	Ordinary balance	+3.101	+3.336	+3.310	+3.556	+3.896	+3.864	+4.081	+4.113	+4.046	+4.347	76.543	−0.00269	55.0717	59.3981
28	......do	2792	Auxiliary balance	+1.030	+1.121	+1.096	+1.199	+1.503	+1.293	+1.510	+1.827	+1.617	+1.133	71.980	+0.00362	57.5067	60.5692
29	......do	2827	Ordinary balance	+5.101	+5.443	+5.060	+5.413	+5.898	+5.936	+6.153	+5.899	+5.939	+6.204	71.259	−0.00473	55.3057	69.2186
30	......do	2829	......do	+3.397	+3.550	+3.667	+3.091	+3.860	+4.114	+4.189	+3.970	+4.081	+4.383	76.087	−0.00401	117.3628	135.4253

APPENDIX B.—*Record of trial of repaired chronometers, January, 1888–July, 1888.*

[In temperature room from January 4 to March 16; after that, in chronometer room. Explanation of abbreviations in first column: Bo., repaired by William Bond & Son; Bl., repaired by John Bliss & Co.; N., repaired by T. S. & J. D. Negus.]

	Time		Jan. 4 to Jan. 11.	Jan. 12 to Jan. 19.	Jan. 20 to Jan. 27.	Jan. 29 to Feb. 5.	Feb. 6 to Feb. 13.	Feb. 14 to Feb. 21.	Feb. 22 to Feb. 29.	Mar. 1 to Mar. 8.	Mar. 9 to Mar. 16.	Mar. 16 to Mar. 23.	Mar. 23 to Mar. 30.	Mar. 30 to Apr. 6.	Apr. 6 to Apr. 13.	Apr. 13 to Apr. 20.	Apr. 20 to Apr. 27.
	Temperature, Fahrenheit		44°.87	55°.02	70°.04	85°.01	90°.01	85°.02	69°.93	54°.95	44°.90	51°.93	52°.75	65°.85	65°.53	63°.08	61°.75
	Relative humidity, per cent.		69.5	68.5	70.7	70.0	69.5	70.0	68.6	67.6	67.7	60.0	64.6	63.5	58.0	58.0	52.0
	Chronometer maker.	*No.*	s.	s.	s.	s.		s.	s.	s.	s.		s.	s.	s.	s.	s.
N.	T. S. & J. D. Negus	1283	−2.493	−1.594	−0.990	−1.630	−2.210	−1.694	−0.851	−1.480	−2.283	−1.576	−1.633	−1.029	−1.011	−1.016	−1.041
N.	....do	1343	−3.529	−2.237	−1.383	−2.059	−2.496	−2.159	−1.601	−2.373	−3.354	−2.255	−2.169	−1.171	−1.119	−0.980	−1.006
Bl.	John Hutton	318	−1.207	−0.273	+0.010	−0.773	−1.031	−0.730	−0.187	−0.730	−1.569	−0.790	−0.847	+0.293	+0.274	+0.234	+0.316
N.	T. S. & J. D. Negus	1345	−1.993	−0.273	+0.689	+0.263	−0.103	+0.199	+0.541	−0.373	−1.783	−0.361	−0.383	+0.971	+0.953	+0.949	+0.816
N.	....do	1308	−4.671	−3.130	−2.669	−3.166	−3.674	−3.123	−2.494	−3.409	−5.104	−3.861	−3.883	−2.600	−2.619	−2.694	−2.756
N.	...do	1273	−2.064	−1.416	−1.061	−2.201	−2.674	−2.266	−1.066	−1.230	−2.176	−1.361	−1.526	−0.814	−0.654	−0.587	−0.506
N.	....do	863	−1.671	−0.737	−0.526	−0.987	−1.531	−1.159	−0.137	−0.659	−1.676	−0.826	−0.883	+0.293	+0.274	+0.591	+0.566
N.	....do	1245	−1.421	+0.049	+0.760	+0.013	−0.174	+0.091	+0.827	+0.199	−1.461	−0.504	−0.419	+1.007	+0.846	+0.663	+0.566
N.	...do	1298	−2.314	−0.880	−0.204	−1.023	−1.639	−1.301	−0.587	−0.873	−1.926	−0.469	−1.097	−0.243	−0.190	−0.194	−0.220
N.	...do	1220	−2.207	−0.880	−0.169	−0.987	−1.353	−0.980	−0.244	−1.266	−2.533	−1.290	−1.204	−0.136	−0.047	+0.020	+0.101
N.	...do	1259	−2.421	−1.523	−1.061	−2.166	−2.674	−2.337	−1.351	−1.873	−3.283	−2.147	−1.811	−1.029	−1.047	−0.944	−1.077
Bl.	John Hutton	352	−2.529	−1.594	−1.097	−2.237	−3.067	−2.480	−1.816	−1.587	−2.961	−2.111	−1.919	−0.957	−0.976	−1.194	−1.149
Bl.	do	225	−2.386	−0.594	+0.796	+0.549	+0.039	+0.841	+0.541	−0.587	−2.533	−0.683	−0.669	+0.936	+0.846	+0.841	+0.709
N.	T. S. & J. D. Negus	1115	−1.314	−0.380	−0.133	−1.451	−2.174	−1.623	−0.530	−0.623	−1.926	−0.897	−0.847	+0.114	+0.060	+0.161	+0.209
Bl.	John Bliss & Co	2484	+0.329	+1.691	+2.689	+1.941	+1.040	+1.591	+2.041	+1.234	+0.074	+1.389	+1.581	+2.471	+2.203	+2.341	+2.351
N.	T. S. & J. D. Negus	1448	−1.814	−0.237	+0.010	−1.523	−2.353	−1.659	−0.494	−0.337	−1.461	−0.433	−0.347	+0.079	+0.024	+0.127	+0.101
N.	.. do	740	−3.171	−2.130	−1.919	−3.416	−3.924	−3.551	−2.030	−2.016	−3.176	−2.254	−2.419	−1.636	−1.797	−1.604	−1.684
N.	...do	1319	−1.064	+0.227	+0.546	−0.594	−1.460	−0.980	−0.137	−0.551	−1.497	−0.290	−0.490	+0.471	+0.203	+0.199	+0.244
Bo.	John Munroe	275	−2.171	−1.951	−1.240	−1.380	−1.317	−1.837	−1.601	−2.551	−4.104	−2.826	−2.990	−1.600	−1.619	−1.730	−1.720
Bl.	John Bliss & Co	2768	−4.207	−2.666	−1.633	−1.666	−0.960	−0.766	−1.137	−2.051	−3.497	−2.040	−1.883	−0.707	−0.833	−1.051	−1.077
Bo.	Barraud	[illegible]	−2.921	−1.809	−1.240	−2.880	−2.889	−2.623	−1.316	−2.230	−3.426	−2.076	−2.169	−1.171	−1.297	−1.194	−1.149
N.	T. S. & J. D. Negus	1583	−0.243	+0.691	+0.617	−1.023	−1.853	−1.051	+0.077	−0.587	−0.569	−0.040	−0.097	+0.757	+0.381	+0.377	+0.316
N.	....do	1452	−1.279	+0.513	+1.617	+0.263	−0.674	−0.337	+0.149	−0.623	−1.854	−0.040	−0.026	+1.364	+1.203	+1.270	+1.030
Bo.	Barraud	1509	+1.364	+2.120	+2.331	+0.441	−0.889	−0.944	−0.030	−0.266	−1.170	−0.540	−0.776	−0.100	−0.154	−0.266	−0.327

APPENDIX B.—*Record of trial of repaired chronometers, January, 1888–July, 1888*—Continued.

	Time		Apr. 27 to May 4.	May 4 to May 11.	May 11 to May 18.	May 18 to May 25.	May 25 to June 1.	June 1 to June 8.	June 8 to June 15.	June 15 to June 22.	June 22 to June 29.	June 29 to July 6.	Temperature of compensation.	Temperature constant.	First trial number.	Final trial number.	Relative number.
	Temperature, Fahrenheit		71°.15	73°.17	71°.14	67°.66	75°.18	73°.15	75°.53	82°.09	83°.56	74°.95					
	Relative humidity, per cent.		58.0	62.7	60.5	62.8	70.1	66.6	68.0	66.7	66.8	62.0					
	Chronometer maker.	*No.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	*s.*	°	*s.*	*s.*	*s.*	
N.	T. S. & J. D. Negus	1283	−0.934	−0.843	−0.869	−0.730	−0.819	−0.779	−0.740	−1.137	−1.419	−0.724	69.310	−0.00302	10.6997	11.2926	1
N.	....do	1343	−0.791	−0.736	−0.869	−0.837	−0.890	−1.064	−1.133	−1.351	−1.347	−1.010	71.028	−0.00318	12.9750	13.7671	2
Bl.	John Hutton	318	+0.673	+0.836	+0.703	+0.734	+0.789	+0.757	+0.689	+.0184	−0.026	+0.240	68.332	−0.00250	8.8287	13.8912	3
N.	T. S. & J. D. Negus	1345	+1.351	+1.443	+1.203	+1.270	+1.396	+1.364	+1.439	+1.113	+1.048	+1.204	73.143	−0.00294	12.5123	14.1299	4
N.	....do	1308	−2.541	−2.414	−2.583	−2.516	−2.497	−2.564	−2.526	−2.709	−2.919	−2.689	70.749	−0.00277	12.3224	14.9145	5
N.	....do	1273	−0.649	−0.629	−0.583	−0.301	−0.819	−0.707	−0.847	−1.459	−1.704	−1.010	65.265	−0.00313	13.8447	15.2608	6
N.	....do	863	+0.780	+0.761	+0.739	+0.913	+0.181	+0.186	+0.046	−0.530	−0.633	−0.010	67.464	−0.00246	8.4756	15.5512	7
N.	.. do	1245	+0.780	+0.693	+0.846	+1.234	+1.289	+1.186	+1.153	+0.434	+0.510	+1.062	69.612	−0.00313	12.1875	16.2679	8
N.	....do	1298	−0.077	+0.050	−0.154	+0.091	−0.146	−0.033	+0.010	−0.459	−0.669	−0.153	68.518	−0.00322	12.2240	16.7609	9
N.	....do	1220	+0.244	+0.229	+0.024	+0.234	−0.033	+0.079	+0.081	−0.387	−0.633	−0.153	70.410	−0.00365	16.7511	17.6160	10
N.	....do	1259	−1.041	−1.164	−1.011	−0.909	−1.247	−1.064	−1.204	−1.566	−1.847	−1.224	67.302	−0.00341	16.9059	17.9059	11
Bl.	John Hutton	352	−1.006	−1.057	−1.511	−1.087	−1.676	−1.636	−1.526	−1.923	−2.133	−1.474	66.250	−0.00341	15.2601	18.0160	12
Bl.	....do	225	+1.066	+1.193	+1.096	+1.127	+1.181	+1.079	+1.189	+0.934	+0.689	+0.847	75.241	−0.00329	17.5206	18.4615	13
N.	T. S. & J. D. Negus	1115	+0.137	+0.229	+0.096	+0.377	+0.039	+0.114	−0.026	−0.744	−1.097	−0.260	64.353	−0.00306	16.6490	20.3739	14
Bl.	John Bliss & Co	2484	+2.601	+2.693	+2.489	+2.520	+2.646	+2.686	+2.903	+2.399	+2.189	+2.704	71.518	−0.00334	19.3613	20.6609	15
N.	T. S. & J. D. Negus	1448	+0.030	+0.014	+0.096	+0.377	+0.217	+0.293	+0.260	−0.244	−0.561	+0.240	62.985	−0.00309	19.9914	21.4555	16
N.	... do	740	−1.720	−1.771	−1.940	−1.694	−1.854	−1.779	−1.883	−2.494	−2.847	−2.117	63.423	−0.00357	19.6642	21.5138	17
N.	....do	1319	+0.280	+0.300	+0.203	+0.413	+0.324	+0.293	+0.296	−0.101	−0.454	+0.061	66.546	−0.00301	20.5077	22.2238	18
Bo.	John Munroe	275	−1.399	−1.343	−1.619	−1.516	−1.497	−1.5 9	−1.419	−1.494	−1.561	−1.510	78.709	−0.00171	20.6647	23.1928	19
Bl.	John Bliss & Co	2768	−0.649	−0.450	−1.297	−1.337	−0.997	−1.243	−1.204	−1.030	−1.240	−1.224	88.845	−0.00123	18.5050	25.4746	20
Bo.	Barraud	[illegible]	−1.113	−1.129	−1.333	−0.944	−1.747	−1.636	−1.669	−2.244	−2.526	−1.867	67.520	−0.00492	34.9219	38.0548	21
N.	T. S. & J. D. Negus	1583	+0.316	+0.371	+0.310	+0.449	+0.431	−0.100	−0.061	−0.673	−0.954	−0.117	65.135	−0.00373	36.0753	39.7617	22
N.	....do	1452	+1.566	+1.550	+1.453	+1.591	+1.503	+1.507	+1.367	+0.863	+0.439	+0.704	70.073	−0.00413	53.3545	55.6045	23
Bo.	Barraud	1509	−0.256	−0.271	−0.404	−0.266	−0.747	−0.421	−0.490	−1.209	−1.454	−0.617	64.560	−0.003608	127.5806	128.5215	24

APPENDIX C.

[Report of Commander Allan D. Brown.]

U. S. NAVAL OBSERVATORY,
Washington, October 1, 1888.

SIR: The work of the division of verification of instruments was carried on by Ensign Clements, under my general supervision, until the 1st of July; since that date Mr. Clements has been absent in attendance on the Cincinnati Exposition.

CLASS A.—SEXTANTS AND OCTANTS.

There have been received for examination, prior to repairs, twenty sextants; of these, four have been condemned. There were on hand at date of last report thirty-two sextants; of these, fifteen have been issued to ships in commission, and two sent to the Cincinnati Exposition; sixteen have been repaired, but all have not been critically examined for errors of eccentricity. The total number on hand is thirty-one.

CLASS B.—THERMOMETERS.

At the request of the Supervising Surgeon-General of the Marine Hospital Service, one hundred and nine clinical thermometers were examined and duly returned with a certificate attached to each. Four were broken and thirteen were found to be unreliable, showing a decided improvement over those examined for the same service last year.

A Draper recording thermometer was also received from the agents in this city and placed under comparison. The recording apparatus worked well, but the results of the trial showed that the thermometer did not respond quickly to atmospheric changes, and it can not be regarded as a reliable instrument for use in the service.

CLASS C.—SPY-GLASSES.

Twenty-five spy-glasses, by Elliott Brothers, were received early in the year and duly examined. They were found to be superior to those previously received from the same firm, and have been issued for service. Two other glasses (one by Avizard, of Paris, presented to the observatory by the manufacturer through Lieutenant Winterhalter) have also been examined. The Avizard glass, upon comparison with No. 16 Elliott (retained as a standard), showed optical superiority, and it has been, by the Bureau's direction, made the standard to which in future the optical performance of glasses must attain.

CLASS D.—STATION POINTERS.

No instruments of this class have been examined.

CLASS E.—CLINOMETERS.

One Evelyn's patent ship clinometer has been presented to the observatory by Lieutenant Winterhalter, to whom it was presented by the inventor.

CLASS F.—BAROMETERS.

No instruments of this class have been examined.

CLASS G.—BINOCULARS.

Twenty-eight pairs of binocular glasses have been submitted for examination; of these, four by Steinheil and two by Avizard (purchased by the Bureau's order by Lieutenant Winterhalter) have been accepted. One "standard" and one "ordinary" by Bardou have also been accepted. Of the others examined, none have been found fully equal to the wants of the service. As one of the results of the examination, it was ascertained that glasses manufactured in Europe and imported into this country have too great a distance between the axes; from which it would appear that the pupils of the eyes of Americans are nearer together than those of Europeans, if the glasses are made with any view to having this distance correct. I am unofficially informed that the same result has been reached by the Signal Service in their search for binoculars. In view of this fact, it was deemed best to recommend the use of a folding frame, by which the distance between the axes of the tubes can be changed from $2\frac{1}{8}$ to $2\frac{3}{4}$ inches to suit individual cases. A scheme for a "standard" glass was devised and forwarded to the Bureau, where it was approved, and three glasses were ordered to be made in accordance with the specifications laid down. One of these (referred to above as the "standard" by Bardou) has been received, examined, and accepted. There were some slight defects in the manufacture, which will undoubtedly be remedied in the next one made; this (together with one by another maker) is promised for a near date. The specifications call for an object-glass of but 1.5 inches in diameter, and 5.5 inches focal length; the oculars are four in number, set in a revolving disk, giving powers from 3 to 6, making the glass suitable for both night and day use. The weight of the instrument is but $20\frac{1}{2}$ ounces, being 13 ounces less than that of the "ordinary" pattern. It is believed that hereafter the service will be supplied with an excellent glass at no great expense.

RECAPITULATION.

The total number of instruments examined is as follows:

Class A.	Sextants	20
B.	Thermometers	110
C.	Spy-glasses	27
D.	Station pointers	0
E.	Clinometers	1
F.	Barometers	0
G.	Binoculars	28
		186

In addition to the above, a reflecting circle, patented by Capt. Charles Henry Townshend, of New Haven, Conn., was examined by a board consisting of Lieutenant Winterhalter, Ensign Clements, and myself. It was found to possess many advantages for use in hydrographic work, and recommended as a valuable addition to the outfit of a vessel.

Very respectfully,

ALLAN D. BROWN,
Commander, U. S. Navy, Assistant Superintendent.

The SUPERINTENDENT, U. S. NAVAL OBSERVATORY.

APPENDIX D.

[Report of Prof. William Harkness, of the Transit-of-Venus Commission.]

UNITED STATES NAVAL OBSERVATORY,
Washington, October 11, 1888.

SIR: I have the honor to submit the following report of the work done during the past year, under my supervision, for the Transit of Venus Commission:

The assistants employed at the beginning of the year were Messrs. A. S. Flint and H. P. Tuttle. Mr. Tuttle left the service of the Commission on July 31, and since that time Mr. Flint has been the only computer employed.

The work accomplished by Messrs. Flint, Tuttle, and myself may be summarized as follows:

The observations made at the Lick Observatory for determining local time, azimuth, and level of the axis of the photoheliograph, and the interval between the objective and reticule plate of that instrument, were received last December, and were reduced at once. The reduction and discussion of the experiments to determine the radii of curvature of the heliostat mirrors, mentioned in last year's report, has been completed. Additional measurements of the thicknesses of all the reticule plates have been made; their indexes of refraction have been computed from measurements of the linear displacements of small pencils of light passing obliquely through the plates; and the optical thicknesses of all the reticule plates have been deduced, both from the indexes of refraction and from direct measurements effected by focusing a compound microscope alternately through air and through the reticule plates. The focal distances, and positions of the principal points, have been computed from the experiments made in 1884, for all the photographic objectives, and also for each of their component lenses. The measuring rods belonging to nine of the 40-foot photoheliographs have been very carefully compared with each other, and the length of the 10-foot measuring rod which was used in connection with the New Haven photographs has been accurately determined at the office of weights and measures, under the direction of the Superintendent of the U. S. Coast and Geodetic Survey.

The computations of the refractions at Auckland, New Zealand, Lick Observatory, and New Haven, Conn., have been completed, and the differential refractions of Venus relatively to the sun's center have been computed, both in position angle, and distance, for all the stations. The latter work involved the formation of new tables, those used in connection with the 1874 transit being found inadequate. The coefficients of the unknown quantities in the observation equations for determining the solar parallax and the errors of the tables of Venus have been interpolated for Wellington, South Africa; Santa Cruz, Patagonia; Auckland, New Zealand; Princeton, N. J.; the Lick Observatory, California; New Haven, Conn., and the products of these coefficients required for forming the normal equations have been interpolated for Santa Cruz, Santiago, Auckland, Princeton, and New Haven. All the other stations were computed last year.

The method employed in the formation of the absolute terms of the observation equations was as follows: (1) The distances measured upon the photographs between the centers of the sun and Venus were converted into arc without the application of any corrections whatever; and the position angles of Venus relatively to the sun's center and the plumb line were corrected only for such small errors as arose from ac-

cidental want of coincidence between the center of the sun's image and the center of the reticule plate. (2) From the positions of Venus and the sun given in the American Ephemeris, combined with the known hour angles and refractions, tables were computed for each station, giving for every minute of time the theoretical position angles and distances of Venus relatively to the sun's center upon the photographs. (3) The latter position angles and distances were interpolated to the times of the photographs, and the differences between them and the values measured from the photographs gave at once the absolute terms of the observation equations. By this process the risk of error was reduced to a minimum. It may be well to explain that for the computation of the differential refractions used in the tables just described, a pretty exact knowledge of the errors of the tables of Venus was necessary; and that knowledge was obtained by a preliminary solution of the equations yielded by thirty-three photographs distributed among ten of the stations. Advantage was taken of the knowledge thus acquired to make the absolute terms of the observation equations as small as possible.

The distance equations have been formed from all the photographs, their number and distribution being as follows:

Washington	49	Santiago	197
Cedar Keys	165	Auckland	51
San Antonio	121	Princeton	162
Cerro Roblero	216	Lick Observatory	123
Wellington	180	New Haven	86
Santa Cruz	211		
		Total	1,561

As the New Haven photoheliograph was of an entirely different kind from those used at the other stations, the New Haven equations have been temporarily laid aside for further discussion. The solution of the 1,475 equations, obtained from negatives made with horizontal photoheliographs of about 40 feet focus, has given

$$\pi = 8.847'' \pm 0.012''$$
$$\delta A = +2.893$$
$$\delta D = +1.254$$

where π is the solar parallax, and δA and δD are, respectively, the corrections to the right ascensions and declinations of Venus given by Hill's tables of that planet, it being assumed that Hansen's tables of the sun are correct. The corresponding mean distance from the earth to the sun is 92,385,000 miles, with a probable error of only 125,000 miles. The probable error of a distance between the centers of the sun and Venus obtained from the measurement of a single photograph is $\pm 0.715''$.

It is expected that the formation of the normal equations from the position angles will be completed in about a month, and it may reasonably be anticipated that when the results from them are combined with those from the distances, the probable error of the parallax will be somewhat diminished.

Very respectfully,

WM. HARKNESS,
Professor of Mathematics, U. S. N[avy].
of Executive Committee of Transit of Venus C[ommission]

Capt. R. L. PHYTHIAN, U. S. Navy,
Superintendent Naval Observatory,
President of Transit of Venus Commission.

APPENDIX E.

[Letter from Lieut. A. G. Winterhalter.]

U. S. NAVAL OBSERVATORY,
Washington, October 9, 1888.

SIR: I had the honor of reporting my return to the United States from Europe by letter to the Department, dated New York, November 25, 1887, and in person to the Superintendent on November 29.

During my absence, in addition to the cities mentioned in the last annual report of the Superintendent, I visited, under orders of the Department, observatories and establishments of a scientific character in the following places: Meudon, France; Greenwich, Richmond, Ealing, Oxford and Cambridge, England; Leyden, Holland; Düsseldorf, Bonn, Strasburg, Berlin, Potsdam, Dresden, Leipsic and Munich, Germany; Vienna, Austria. It is a duty to say that I was everywhere cordially welcomed as the representative of the Observatory. I trust I may be permitted to indulge the hope that my visits have done good in fostering the kindly relations uniting us to European astronomical institutions. The details of my proceedings are given in the full report which is now in preparation, and which I shall have the honor to submit at an early date.

For the numerous courtesies of which I was the recipient, I beg leave in this manner to present my earnest thanks to those with whose acquaintance I was favored.

I was the bearer of sundry plans, drawings, sketches and photographs, sixty-five in number, which were at various times presented through me to the Observatory, as also of one hundred and thirty-four books, pamphlets and catalogues donated to the library; a list of these presents I shall include in my report.

The following instruments were brought to the Observatory:

One ship's clinometer, presented to me by Col. G. P. Evelyn and by me donated to the Observatory.

One Evelyn's patent bubble-horizon, purchased and tested at sea by order of the Bureau of Navigation.

One sextant-mirror testing apparatus, by G. Hechelmann, Hamburg; purchased by order of the Superintendent.

One pair of high-power binoculars, by MM. R. & C. Avizard, Paris; purchased by order of the Bureau of Navigation.

One pair of low-power binoculars, by MM. R. & C. Avizard, Paris; purchased by order of the Bureau of Navigation.

One marine spy-glass, presented to the Observatory by MM. R. & C. Avizard, Paris.

One pair of high-power binoculars, by HH. C. A. Steinheil Söhne, Munich; submitted for examination and since purchased for trial in the service.

One pair of low-power binoculars, by HH. C. A. Steinheil Söhne, Munich; submitted for examination and since purchased for trial in the service.

One marine spy-glass, by HH. C. A. Steinheil Söhne, Munich; submitted for examination; since returned.

One Jena-glass telescope, aperture 36 Par. lines, with a number of eye-pieces of a variety of constructions, by HH. C. A. Steinheil Söhne, Munich; on trial.

Also, one box of pieces of Jena optical glass, presented by Dr. Adolph Steinheil.

One sextant with "gyroscope-collimator" and attachments, by M. A. Hurlimann, Paris, the invention of Capt. G. Fleuriais, French Navy; purchased and tested at sea by order of the Bureau of Navigation.

During the month of December, 1887, I was engaged principally in making the official reports incident to my return and in drawing up the reports on such of the instruments named as had been tested by me. During July and August, 1888, I was employed in preparing the illustrative and photographic exhibit of the Observatory for the Cincinnati Exposition, while during the month of September I had miscellaneous work. During the remaining six months I have been at work by your order in preparing a report on the results of my observation while in Europe, including an account of the International Astrophotographic Congress, held in Paris, April, 1887. The latter, which forms Part I of the report, comprises 166 manuscript pages and is now in the hands of the Public Printer.

In this connection I beg leave to recommend to your consideration the urgency of a provision to enable the Observatory to do the work which will fall to its share in charting the sky by photographic processes. Already foreign governments have been responding liberally with the necessary funds to allow their observatories to take part in the concerted operations; Germany, England, Brazil, Chili, Spain, Mexico and the Argentine Republic have each one instrument in process of construction; Australia has two photographic telescopes under way, while France has one completed at Paris and three others in the hands of a constructor. Besides, according to my information, instruments of the character prescribed by the congress will, without much doubt, be also built for other observatories in England, Denmark, Austria and Russia. Only one of the thirteen instruments whose construction is assured has been provided by private means and that for an established university observatory. The character and extent of the projected work will exclude the co-operation of private observatories. It is respectfully submitted that the United States, "the home of astronomical photography," is likely to be left without representation in this great international undertaking should the Naval Observatory not be provided with means for doing the share which will naturally be allotted to it.

Very respectfully, your obedient servant,

A. G. WINTERHALTER,
Lieutenant, U. S. Navy.

The SUPERINTENDENT, NAVAL OBSERVATORY,
Washington.

ADDENDUM.

CINCINNATI EXPOSITION.

U. S. NAVAL OBSERVATORY,
Washington, October 30, 1888.

SIR: I have the honor to inclose the reports of Commander A. D. Brown, Lieut. A. G. Winterhalter, and Ensign A. B. Clements on the Observatory exhibit at the Centennial Exposition of the Ohio Valley and Central States, held at Cincinnati, Ohio, with the suggestion that they be appended to the annual report of the Superintendent of the Observatory.

The thanks of the Observatory are due to Mr. T. W. Smillie, of the National Museum, for valuable assistance in preparing the photographic exhibit.

Commander Brown, Lieutenant Winterhalter, Ensign Clements, and Mr. Gardner performed their respective duties in connection with the preparation of the exhibit very efficiently. Through their efforts the principal parts of it were in place at the opening of the Exposition, notwithstanding the late date at which the appropriation became available.

Very respectfully,

R. L. PHYTHIAN,
Captain, U. S. Navy, Superintendent.

The CHIEF OF THE BUREAU OF NAVIGATION,
Navy Department.

UNITED STATES NAVAL OBSERVATORY,
Washington, October 29, 1888.

SIR: In compliance with your directions, I have the honor to submit an account of the Observatory exhibit at the Cincinnati Exposition.

As soon as the appropriation became available the preparations for shipment began. The preparation of the photographic portion of the exhibit was intrusted to Lieut. A. G. Winterhalter, who devoted much time and attention to this duty. The result of his labor was a series of photographs of the Observatory, instruments, etc., much more complete than the Observatory has ever before possessed. The report made by him gives a list of the portion of the exhibit so prepared.

The time-service exhibit was a complete representation of the system pursued in the distribution of time by the Observatory, and consisted of—

(1) Astronomical clock, with transmitting attachment.*
(2) Chronograph.
(3) Transit instrument.
(4) Relays, sounders, repeaters, etc., for distribution of signals in the exhibition building.
(5) Time-ball.
(6) Gardner clock to show intercolonial (or sixtieth meridian) time.
(7) Gardner clock to show eastern (or seventy-fifth meridian) time.
(8) Gardner clock, showing central (or ninetieth meridian) time.
(9) Gardner clock, showing mountain (or one-hundred and fifth meridian) time.
(10) Gardner clock showing Pacific coast (or one hundred and twentieth meridian) time.
(11) Time-gongs.
(12) Map showing 30,000 miles of railroad receiving the time-signals from the Observatory.
(13) Map showing the different divisions of the standard-time system.

In addition to this were three houses of the Transit-of-Venus Commission pattern, containing, respectively, a photoheliograph, an equatorial telescope of 5 inch aperture, and the transit instrument mentioned above. There was also sent for exhibition a magnetometer, with a dip circle of the Transit-of-Venus Commission pattern.

All the articles mentioned above were shipped from the Observatory by the 30th of June, and were at the Exposition building before it was

*Property of Seth Thomas Clock Company.

entirely ready for their reception. The packing and work of preparation therefore were done by Mr. William F. Gardner, to whom much credit is due for the promptness with which the work was performed.

Very respectfully,

ALLAN D. BROWN,
Commander, U. S. Navy, Assistant Superintendent.

The SUPERINTENDENT, U. S. NAVAL OBSERVATORY.

U. S. NAVAL OBSERVATORY,
Washington, October 9, 1888.

SIR: The illustrative and photographic exhibit of the Observatory at the Centennial Exposition of the Ohio Valley and Central States, held at Cincinnati, Ohio, the preparation of which was by your order intrusted to me, was forwarded to that city in July and August last.

I have the honor to submit herewith a list of frames displayed.

List of frames displayed.

No.	Size of illustration.	Description.
	Inches.	
1	14 x 46	Drawing: Elevation of main building, New Naval Observatory.
2	14 x 46	Drawing: Section of same.
3	16½ x 41	Drawing: The new great dome.
4	22 x 28	Photograph: Time-ball station at Telegraph Hill, San Francisco.
5	22 x 48	Photographs: Curves of declination, horizontal and vertical forces, typical of ordinary, moderately disturbed, and greatly disturbed conditions of terrestrial magnetism.
6	27 x 40	Photograph: Group of members of International Astrophotographic Congress, by Nadar, Paris.
7	20 x 26	Three photographs of phases of solar eclipse; three of transit of Venus; taken with the horizontal photoheliograph.
8	30 x 40	Eight drawings showing the workings of the Gardner Observatory time system, arrangements of transmitting clocks and time-balls.
9	27 x 40	Photographic enlargement: Grounds of New Naval Observatory and location of projected buildings.
10	30 x 40	Photograph: The great dome and prime-vertical room.
11	30 x 40	Photograph: The smaller dome and adjacent parts of main building.
12	30 x 40	Photograph: The transit-circle building.
13	30 x 40	Photograph: Compass-house No. 1.
14	30 x 40	Photograph: Compass-house No. 2.
15	34 x 40	Nine views of buildings and instruments.
16	34 x 40	Do.
17	34 x 40	Do.
18	16 x 18½	Photograph: Transit instrument and mural circle.
19	16 x 18½	Photograph: The transit circle.
20	16 x 18½	Photograph: The great equatorial.
21	16 x 18½	Photograph: The 9.6-inch equatorial.
22	25 x 28	Drawing of Omega nebula, as seen through the great equatorial.
23	25 x 36	Drawing of Orion nebula, as seen through the great equatorial.
24	30 x 36	Drawing of Saturn, as seen through the great equatorial.
25	17 x 22	Drawing of Ring-Nebula in Lyra, as seen through the great equatorial.
26	30 x 36	Photograph: Solar Eclipse, March 15-16, 1885; diameter of Sun's disk, 26 inches.
27	20 x 26	Drawing: Total eclipse of the Sun, July 29, 1878.

The above illustrations, with few exceptions, were newly made for the purpose in hand. In the execution of several of them I had the efficient and valuable assistance of Mr. T. W. Smillie, of the National Museum, freely given in the midst of his own exacting labors, the Secretary of the Smithsonian Institution, Prof. S. P. Langley, having accorded the necessary facilities at the request of the Superintendent.

In response to a letter of Prof. J. Brown Goode, assistant secretary in charge of the National Museum, addressed to the Superintendent, a

number of photographs were furnished that institution, showing the uses of photography in representing lunar, solar, and stellar phenomena, and in recording changes in the earth's magnetic forces and including views of instruments used for such purposes. Copies of these, I am informed, were exhibited at Cincinnati, and on their return to Washington will form part of an interesting exposition of the history of photography prepared for the Museum by Mr. Smillie.

Very respectfully, your obedient servant,

A. G. WINTERHALTER,
Lieutenant, U. S. Navy.

The SUPERINTENDENT, U. S. NAVAL OBSERVATORY,
Washington.

U. S. NAVAL OBSERVATORY,
Washington, October 29, 1888.

SIR: I have the honor to submit the following statement concerning the exhibit of the Naval Observatory at the Centennial Exposition of the Ohio Valley and Central States, held at Cincinnati, Ohio.

I reached Cincinnati June 29, several days before the opening of the exposition, and remained there until detached, October 23.

The space allotted to the exhibit of the Navy Department was the southern part of the east wing of the Park Building and the northeastern part of the south wing of the Government annex. Of this the Observatory exhibit was assigned a platform about 6 inches high and some 36 feet long by 12 wide along the northern wall of the annex building, which seemed admirably adapted for the purpose.

The building was not completed until July 2, at which time we began unpacking and placing the exhibit. The time-service exhibit was the first to be placed in position and was in operation at the time of the opening of the exposition, July 4. Every facility for the receipt of signals and all the assistance in their power was cheerfully given us by the officials of the Western Union Telegraph Company; to Manager Page, of the Cincinnati office, we were specially indebted for valuable aid. A special wire was run from the local office to the Observatory exhibit for the use of the time-service, and was so carefully attended to that no fault occurred in that circuit during the exposition. This line and one of the Observatory time-gongs were used in opening the exposition, signals from Mrs. James K. Polk, at Nashville, Tenn., being struck on the time-gong temporarily placed on the Music Hall stage for that purpose.

The disposition of the exhibit was generally as follows: The sidereal clock, chronograph, Gardner clocks, telegraphic instruments, maps, photographs, drawings, and magnetic instruments were placed on the platform in the naval exhibit. The time-gongs were placed, one near the fountain in the center of Park Building, the other over the canal in machinery hall; a third gong, a part of the exhibit of the Ohio State University, was connected with the same circuit and struck by the time signals. The time-ball was placed on a platform 16 feet high and 8 feet square, erected on the tower over the main entrance to the Park Building, on Elm street. The observatory houses, the photoheliograph and heliostat, equatorial, and transit houses, with their instruments set up for use, were placed in the southeast corner of the park, just outside the Government annex.

Five clocks of the Gardner system, showing intercolonial, eastern, central, mountain, and Pacific coast time, respectively, were kept run-

ning continually and were corrected daily by the noon signal. The clocks and time-ball gave no trouble whatever, responding promptly and accurately to every signal. The time signals were received with the greatest regularity; we failed to receive them on only about half a dozen occasions during the one hundred days, and only once failed by reason of a fault outside the local line in Washington City.

The observatory houses in the park were open to the public for two hours, from 1 to 3, each afternoon, and the photoheliograph image of the sun was shown every day on which the sun was visible. The equatorial house was open on clear nights, and an opportunity to view the heavens through the telescope was afforded many visitors.

I believe the Observatory exhibit was an attractive feature of the Government display, the time-service especially attracting much attention.

Very respectfully, your obedient servant,

A. B. CLEMENTS,
Ensign, U. S. Navy.

Capt. R. L. PHYTHIAN, *U. S. Navy,*
Superintendent, U. S. Naval Observatory, Washington, D. C.

REPORT OF SUPERINTENDENT OF NAUTICAL ALMANAC.

NAUTICAL ALMANAC OFFICE,
BUREAU OF NAVIGATION, NAVY DEPARTMENT,
Washington, October, 1888.

SIR: In compliance with the order of the Bureau I have the honor to submit the following report of the work of this office during the past year.

PRINTING.

The American Nautical Almanac for the year 1891 was issued from the press in April, 1888.

The American Ephemeris for the same year appeared in September, 1888.

The Atlantic and Pacific Coaster's Nautical Almanacs for the year 1889 were also issued in September.

Of the Almanac and Ephemeris for 1892, 325 pages are in type.

DISTRIBUTION.

During the fiscal year ending June 30, 1888, the sale and distribution of the preceding publications were as folows:

Publications.	Sold.	Distributed.
American Ephemeris	616	668
American Nautical Almanac	2,216	....
Atlantic Coaster's Nautical Almanac	742	....
Pacific Coaster's Nautical Almanac	796	....

The proceeds of sales, amounting to $1,401.25, have, in compliance with law, been deposited in the Treasury to the credit of the appropriation for public printing and binding.

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The computation of the geocentric places of Mars has been completed as far as 1850, and the concluding portion, 1850–1864, is about half finished.

Theory of Jupiter and Saturn.—Since my last annual report the provisional tables of these planets have been completed by Mr. Hill, who is now engaged in a description of their construction and use. These tables are still to be corrected by comparison with observations since 1750. The work of correction can not, however, be finally completed until that on the four inner planets is ready.

Mass of Jupiter.—Yet another branch of the planetary work is the determination of the mass of Jupiter from the motions of Polyhymnia. As stated in previous reports, the perturbations of this planet have been computed from the epoch of its discovery in 1854 up to October, 1888. The work awaits observations during the opposition of September and October, after which the final discussion can be taken in hand. These observations have been particularly requested from seven observatories in this country and Europe.

Very respectfully, your obedient servant,

SIMON NEWCOMB,
Superintendent Nautical Almanac.

The CHIEF OF THE BUREAU OF NAVIGATION,
Navy Department.

No. 7.—BUREAU OF ORDNANCE.

BUREAU OF ORDNANCE, NAVY DEPARTMENT,
Washington City, October 31, 1888.

SIR: I have the honor to submit the annual report of this Bureau, and also to transmit estimates for the fiscal year ending June 30, 1890.

(1) Fuel, tools, material, and labor; prizes for enlisted men; proof of naval armaments; batteries of the new types for two ships now in service; towards the general armament of the Navy with modern secondary batteries and small-arms	$514,150
(2) General repairs to ordnance buildings, magazines, and appendages	15,000
(3) Freight and miscellaneous expenses	10,000
(4) Civil establishment at navy-yards	24,980
(5) General expenses of the torpedo station, torpedo-boat marine railway, and enlarging torpedo-boat house	70,000
(6) Towards the armament of vessels authorized	4,077,000
(7) For completion of the gun plant at the Washington navy-yard	625,000
	5,336,130

CANNON.

The number of high-power steel cannon for the Navy completed to date is as follows:

5-inch	2
6-inch	24
8-inch	8
10-inch	3

Since the last annual report was made a new design of 6-inch gun has been completed and thirty-two of these guns are in process of construction at the navy-yard, Washington; at the West Point Foundry, Cold Spring, N. Y; and at the South Boston Iron Works, Boston, Mass. The navy-yard, Washington, has practically finished ten.

This design is in several important respects superior to those heretofore in use. The tube is hooped to the muzzle, thereby greatly strengthening it against strains in the chase. The powder chamber has been reduced in diameter, thereby enabling us to reduce the exterior diameters of the body of the gun, and to save sufficient weight at that point to enable us to hoop the gun at the muzzle without any increase over the weight of the former models. The rifling of this gun is somewhat different from that of those that have heretofore been built, and it will be seen in cross-section in the appendix. The groove removes less metal from the gun than is the case with the ordinary groove, and will probably be subject to less erosion from powder gas. The twist increases from zero at the origin to one turn in twenty-five calibers at the muzzle, the curve being the semi-cubical parabola. The

breech mechanism has been improved in several important respects, and the gun is considered to be rather superior to the best types of guns of its class and kind now extant abroad. A drawing of this gun will be found in the appendix.

The standard type of 8-inch gun has been improved on the same lines as indicated above. A drawing of it will be found in the appendix. The character of the rifling in this case is the same as that in the new 6-inch gun, the twist increasing from zero at the origin to one turn in twenty-five calibers at the muzzle.

The designs for a new model of 10-inch gun are completed.

This gun is likewise of less external diameter than the former type, a saving of weight of 1,200 pounds being thereby accomplished. The cross-section of the rifling is the same as that described above for the 6-inch and 8-inch guns. The twist increases from zero at the origin to one turn in twenty-five calibers at the muzzle.

The general system upon which these guns are built is, however, virtually the same as that which has been in use by the Bureau since the commencement of the manufacture of the new armament.

A 10 inch gun, Mark I, intended for the U. S. Monitor *Miantonomoh*, has been lately fired at the Naval Ordnance Proving Ground, the projectile showing a velocity of 2,002 feet per second at the muzzle.

The Bethlehem Iron Company has its plant for the production of gun forgings practically completed, and will probably commence the production and delivery of forgings during the month of December next.

In Europe considerable attention has lately been given to the development of the rate of fire of canon of moderate caliber, and what are known as "quick-firing guns" of 3, 4, and 6 inches diameter of bore are being experimented with. Facility of loading is of course a prime requisite of the quick-firing gun, and in order to contribute to this result the projectile and cartridge should be as light as is consistent with the necessary ballistic power. This object is partially obtained by reducing the weight of the cartridge to about one-third that of the projectile, while the length of the bore is increased to about forty calibers in order to favor a high velocity and to give full play for the development of the characteristics of a new kind of powder which has lately been introduced abroad and which powerfully contributes toward the velocity of the projectile. The breech mechanism of these guns is simplified as much as possible, and metallic cartridge cases are used. It is thought that the cartridge and projectile can be conveniently handled in one as fixed ammunition as high as the 4-inch caliber inclusive.

The Bureau has been working on preliminary designs of quick-firing guns, and in the appendix will be found sections showing the general characteristics of the pieces as projected.

POWDER.

No material change has been made in the composition of American brown powder as used by the Bureau in the 6-inch guns since the date of the last report. This powder, in charges of about one-half the weight of the projectile, acts uniformly, and gives a velocity of 2,000 feet per second in four expansions, with a pressure of about 15 tons, the density of charge being from .95 to 1. This is quite as satisfactory an exhibit as is attained by this kind of powder in Europe. The Bureau has decided to use a size of prism of somewhat less diameter but greater height than that heretofore manufactured. This prism is of such size

as will build up conveniently into cartridges for any caliber of our guns from 5-inch to 12-inch inclusive. The presses for the powder are nearly completed by Messrs. DuPont, of Wilmington, Del.

The manufacture of brown powder for the 8-inch and 10-inch guns has proceeded, and a number of samples for each class of gun have been presented and tried at the proving-ground. The powder for these calibers has apparently offered more difficulty to the manufacturers than that for the 6 inch gun. The required velocity is readily obtained, but the pressures are rather higher than is the case in the 6-inch gun on the same density of charge. Still, it is thought that a satisfactory performance will soon be obtained.

The sphero-hexagonal black powder, which was manufactured for use in the 6-pounder rapid-fire gun, was intended also for use in the 3-pounder rapid-fire gun, but in practice proved unsatisfactory in the latter piece. Messrs. DuPont have, however, lately produced a powder, the grains of which are in the shape of a square lozenge, which acts satisfactorily both in the 3 pounder and the 6 pounder, and will be adopted for the present as the powder for those guns. Messrs. DuPont have shown great interest, industry, and skill in dealing with the whole question of brown and other powders for the new armament.

The new powder referred to in a preceding paragraph as being introduced abroad for guns of moderate caliber appears to have shown remarkable results in those pieces, a charge one-third the weight of the projectile giving, in a bore 40 calibers long, a muzzle velocity of a little less than 2,400 feet per second, with a chamber pressure of about 18 or 19 tons.

These are, of course, remarkable results, but information regarding them is not very definite or perfectly satisfactory. However, it is clear that an effort must be made to so change the characteristics of our powder in this country as to produce analogous results. The Bureau has drawn the attention of the prominent powder-makers of the country to this matter. This new foreign powder is said to absorb moisture very rapidly, and is therefore objectionable in that respect. It is, perhaps, questionable whether in its present form it can be conveniently adapted to the conditions of ordinary service afloat.

PROJECTILES.

The form of cast-iron projectiles has not changed in any important respect within the last year. They are produced with facility.

Heretofore the Bureau has had no success in obtaining cast-steel common shell or shrapnel of proper quality for service. Within a short period, however, a few cast-steel shells have been submitted by the manufacturers which have passed inspection and will doubtless be suitable for service. This is a most gratifying fact; and if the output continues equally good, we will soon secure a supply of these absolutely essential projectiles.

The Bureau regrets to say that only two armor-piercing shells (of 8-inch caliber) have been furnished during the last year. Of these, one cracked in store from temper strains, and the other is ready for trial and will be shortly fired from the 8-inch gun against a 10 inch compound plate manufactured by Sir John Brown, of Sheffield, England, which has been on hand several years. If it endures this test successfully, others can be immediately ordered of the same kind, as all the particulars of its manufacture and treatment are known.

FUSES AND PRIMERS.

Several alterations in the standard naval percussion fuse have been suggested within the last year. They have more or less merit, and will be found figured in the appendix.

A thoroughly reliable adjustable service time-fuse is still wanting, and is being sought for by experiment. Lieut. S. H. May, U. S. Navy, has devised several forms of electrical primers for great guns. They have been experimented with at the proving ground, and have, as a rule, been satisfactory. He has also elaborated several forms of friction primers. The drawings will be found in the appendix.

CARRIAGES.

Work on carriages for the new guns has progressed considerably since the last report. Orders have been placed for thirty-two sets of steel castings for the 6-inch central pivot carriages for the new ships. Some of the steel-makers still find difficulty in obtaining the necessary ductility in these castings, but on the whole they are reasonably successful, and thus far thirteen sets have passed the ballistic test. The parts of this carriage are so arranged as to be put together with the least amount of machine finishing that seems practicable at present. The Bureau, however, expects that in time steel-top carriages and steel slides may each be cast in one piece, and it is proposed to try such casting when convenient opportunity offers.

One of these central pivot carriages for the new 6-inch guns is now on the way to the Naval Ordnance Proving Ground, where it will be tested. This carriage is shown in the appendix, where is shown also a proposed change in the contour of the rear end of the bracket.

A cast-steel central pivot carriage for 8-inch guns has also been designed, and the working drawings are now about completed.

This type is intended for mounting the 8-inch guns of the *Charleston* and *Baltimore*. It is strong and simple in construction. A drawing will be found in the appendix.

The Bureau is now at work upon a design for a carriage for rapid-fire guns of 6-inch caliber, and the preliminary drawing will be found in the appendix.

The 8-inch central pivot carriages of the *Chicago* are completed, and it is hoped to have them shipped speedily to the vessel at New York. A drawing of this carriage will be found in the appendix.

Some time since the Bureau ordered an electric motor from the Sprague Electric Railway and Motor Company for training one of the 8-inch guns of the *Chicago*. Good progress has been made upon this motor, and it is hoped that it will be ready for trial on the gun-carriage during the approaching cruise of the ship.

Steel deck-circles have lately been fitted to the *Atlanta* and *Boston* to replace the bronze circles which were formerly used; and steel clips have been placed upon the carriages to replace the bronze clips. At the late trial of the ordnance of the *Boston* before she proceeded upon her cruise to the West Indies, all these fittings worked in a perfectly satisfactory and efficient manner.

The first of the 10-inch carriages intended for the *Miantonomoh* has been erected at the Naval Ordnance Proving Ground, the gun mounted, and a few rounds fired. It is apparent that the carriage will perform its functions satisfactorily, though, owing to the want of solidity of the

platform at the proving ground the different parts of the carriage can not be adjusted to each other with that correctness which will obtain on board of the *Miantonomoh.* The control of recoil is ample, and it is apparent that the hydraulic working arrangements will function well.

The other three carriages for the *Miantonomoh* are being built in the ordnance shops at the Washington navy-yard, and are making good progress, one of them being practically finished.

SECONDARY BATTERIES.

The Hotchkiss Ordnance Company is now engaged in filling its contract with the Department for the following Hotchkiss guns, with supply of ammunition for the whole:

6-pounders	30
3-pounders	22
1-pounders	10
37^{mm} revolving cannon	32

These are being constructed at the works of the Pratt & Whitney Company, of Hartford, Conn., and the ammunition at the works of the Winchester Repeating Arms Company, New Haven, Conn.

The company has met with the usual difficulties in developing a new branch of manufacture, but has made good progress and will soon make a delivery, both of guns and ammunition, under its contract.

It has been more difficult to obtain steel forgings of the proper quality for the manufacture of these guns than was expected would be the case by the Bureau or by the company; but this branch of the work is progressing reasonbly well, and there is no doubt of success therein. The guns and ammunition are intended for the armament of the ships now building, and to all appearances will be ready in time.

The Bureau is considering the advisability of introducing a rapid-fire gun of about 3-inch caliber, carrying a projectile of 14 or 15 pounds with the highest attainable muzzle velocity. It is thought that rapid-fire guns of greater weight of metal than the above belong naturally to the main battery of ships, and mention of them will be found under the heading "Cannon" at the beginning of this report.

The Bureau has designed a recoil mount with automatic return for Hotchkiss guns, and also a cage mount of cast-steel and a steel cone mount. The recoil mount will be shortly tried at the Naval Ordnance Proving Ground, and if successful will be furnished to the new ships, as also will the others. They will be found figured in the appendix, and are due to Lieut. F. F. Fletcher, U. S. Navy.

There has been no material change of late in musket-caliber machine guns working by hand.

Last winter Mr. Hiram Maxim sent to the Department three of his automatic machine guns of .45 caliber. A preliminary exhibition of their working was given at the Washington navy yard, where they performed well, firing 500 to 600 shots per minute.

A more extended test of these guns was afterwards made at the Naval Ordnance Proving Ground, where, though they worked well in the main, their performance was not wholly satisfactory on account of imperfection of workmanship. On being informed of this fact, Mr. Maxim stated that he would send one or more new guns carefully constructed and fitted to fire the naval .45-caliber cartridge. It is supposed that this will be done in due time.

The Bureau has invited Mr. Maxim to submit for trial one or more of his automatic guns of larger caliber, such as are intended for the sec-

ondary batteries of ships of war, and it is hoped that an opportunity may soon be had of witnessing the performance of these pieces. The automatic feature in secondary batteries appears decidedly promising and would be of great importance in war.

SMALL-ARMS.

Pursuant to the plan mentioned in the last report, a contract has been made with the Colts Arms Company of Hartford, Conn., to manufacture for the Navy 5,000 revolvers of a new design. This arm combines simultaneous extraction, with a chamber cylinder which revolves sidewise by a hinge motion, permitting convenient and rapid loading. It is somewhat lighter than the old naval revolver and is considered in every respect much superior to it. The sample revolvers, on which the inspection of the rest of the contract is to be based, are very nearly finished, and a considerable amount of preliminary work on the contract has been done.

For drawing of this revolver see appendix.

The Bureau has found it necessary to purchase 1,500 small-arms for immediate use in the ships which are now approaching completion. The Lee magazine rifle of the latest construction has been selected, and a contract has been made with the Lee Arms Company. As remarked in a former report, the Bureau orders as few small-arms of .45 caliber as possible, believing that a reduction of caliber will soon take place. Lieut. W. W. Kimball, U. S. Navy, has been of great service in connection with the designs of the revolver.

ARMAMENT OF THE NEW VESSELS.

March 30, 1888, Congress having appropriated $175,000 for the completion of the armament of the *Boston*, *Chicago*, and *Atlanta*, the Bureau (which previously had no funds available for this purpose) proceeded at once with the work upon those vessels and has completed the armament of the *Boston*, has virtually completed that of the *Atlanta*, and that of the *Chicago* is in such a state as will lead to its completion in about two months. As soon as the money appropriated by act of Congress of March 3, 1885, and by subsequent acts became available, the Bureau took measures to procure the necessary gun forgings and other material for the outfit of such of these ships as would probably be first completed. The manufacture of the guns has been pressed as rapidly as possible at the gun factory, and the assistance of two private establishments has been obtained for this purpose. The work of the building of the carriages, the manufacture of the battery, equipments, and ammunition is also proceeding with all practicable dispatch, and it is thought that in case 8-inch forgings can be obtained soon from the Bethlehem Iron Company the 8-inch guns of the *Charleston* and *Baltimore* may be completed within a reasonable time. It is hardly possible, however, that they will be finished by the time these vessels are ready, as the forgings have not yet been made by the contractors. It is probable that all the armament, excepting the 8-inch guns, can be prepared by the time the vessels are ready to receive them.

The Hotchkiss guns and the Howell torpedoes, lately contracted for by the Department, are intended for the armament of part of these ships.

The forgings for the 10-inch guns of the *Maine* and of the monitors, and for the 12-inch guns of the *Texas* are not due from the contractors for some time yet.

THE BETHLEHEM CONTRACT.

No gun forgings have as yet been received under the Bethlehem contract, but the Bureau is informed that the company will probably begin deliveries within a month. The smaller hydraulic forging press and the casting press which the firm ordered in England have arrived and have been erected in the works. The steel furnaces are finished and ingots have been run from them. It is understood that the larger forging press for 10-inch and larger guns is not yet completed. The tools and apparatus for rough turning and boring gun forgings have been erected.

The company has consented to deliver first the forgings for six 8-inch guns. These, as remarked before, will be used towards the armament of the *Charleston* and *Baltimore*.

The erection of a hammer for the manufacture of armor plates has not yet been commenced by the company.

NEW GUN FACTORY.

Since the date of the last annual report traveling cranes for the new gun factory have been contracted for and are now nearly ready for delivery. The crane supports were also contracted for and are in process of construction, and those for the smaller cranes are now being delivered. Those for the 110-ton crane are expected shortly.

The walls of the large gun shop are virtually finished. The iron framing for the roof and clear story has been contracted for and is nearly ready for delivery and erection.

The 8-inch gun shop has been entirely cleared out, the earthen floor leveled, the piers for the crane-supports all completed, and the shop made ready for the placing of the concrete floor as soon as the crane-suppo:ts are erected.

In the south end of the gun-carriage shop piers for the supports of the 25-ton traveling crane are now being laid, and the piers for the supports of the 110-ton traveling crane in the large gun shop are about completed.

Great difficulty was experienced in excavating the shrinking pit, owing to the existence of quicksand at the point where it was to be placed. On this account the expense of the shrinking pit has been very much greater than was expected, but it has progressed so far now as to be entirely safe, all difficulties of construction having been successfully overcome.

The steam-engines thus far ordered by the Bureau for the gun factory have been completed by the contractors. The boilers for furnishing power are very much advanced and will soon be finished.

A considerable amount of the machinery now on hand in the ordnance shops and intended for installation in the new gun shops has been repaired and put in complete order.

Nearly all the new machinery, excepting the 16-inch boring and turning lathes and the 16-inch jacket lathes, has been contracted for and is in course of construction.

The Department advertised for proposals for 16-inch boring and turning lathes and 16-inch jacket lathes, but the proposals being unsatisfactory were not accepted and new advertisements are to be issued. Data for the use of bidders on these large tools are now being prepared.

The cost of the gun factory as far as it has advanced is shown in the appendix, where will also be found plan views of the different shops, showing the proposed location of the machinery.

ARMAMENT OF CERTAIN SHIPS NOW IN SERVICE.

A few of the third-rate wooden ships last built for the Navy are still in service, and the Bureau considers it desirable that two of them should receive a modern armament. This armament can be completed in time for them to use it at least one cruise, after which the guns and equipments would answer for use in newer ships. Accordingly a request for a sum of money for this purpose has been inserted in the estimates of this year.

It is furthermore considered that a few rapid-fire guns of small caliber should be bought for the use of the old ships still in service; also some cadet magazine rifles for the use of the Naval Academy. A sum of money for this purpose will also be found in the estimates.

NAVAL ORDNANCE PROVING GROUND.

This establishment has continued during the past year under the very efficient superintendence of Lieut. Austin M. Knight, inspector of ordnance, in charge. It has done a large amount of most necessary and useful work for the Navy, and Lieutenant Knight's assistants have contributed greatly to the success of the work by their attention and intelligence.

The work has included, among other matters of less importance, the proof of guns and carriages and of mounts for the secondary batteries of ships, the development and test of powders for both old and new armaments, including Hotchkiss guns of various calibers, ballistic tests of steel material for gun carriages, gun shields, etc., the trial of cast-steel common shells, the firing of high explosives from powder guns, the ranging of guns and construction of range tables, the statutory test of the service 5-inch breech-loading rifle, the test of the Maxim automatic machine gun, and various minor but necessary tests and trials.

The tests of all service guns have occurred without accident of any kind; and the breech mechanism, gas checks, and firing attachments have, after adjustment, proved very satisfactory.

These guns have been also used in experimental work with new powders, and while so employed have at times sustained pressures much above those fixed for service. In fact, our guns are constructed to sustain a chamber pressure at the elastic limit of the material very considerably above that now in use as the standard pressure, and the Bureau is thinking seriously of the advisability of increasing the standard pressure with the object of obtaining greater muzzle velocities than 2,000 feet per second.

The usual firings for the proof of service powder have been held from time to time as occasion required. As before remarked, the brown powder for the 6-inch gun is satisfactory, and that for the 8-inch gun is nearly so, the only difficulty encountered being rather too high a chamber pressure for the density of charge which we desire to use. It is probable, however, that this fault will be satisfactorily corrected. The powder for the 10-inch gun is still in course of development.

Besides the firing of shells loaded with wet, compressed gun-cotton, the Bureau fired from a 6-inch gun, with about 1,700 feet muzzle velocity, a few rounds of shells loaded with a mixture styled "inert nitroglycerine," presented by Mr. S. D. Smolianinoff. Three rounds were fired from the gun without accident. Of these, one exploded on impact with the water. In order to reach any conclusion in the matter of firing a high explosive from cannon, of course many more rounds should be

fired. The foregoing experiment is regarded as interesting but not entirely satisfactory, and it s probable that further experiments will be made with this mixture.

The ranging of guns is always attended with great delay at our proving ground, on account of the presence of vessels and boats in Chesapeake Bay. The range of modern guns is so great as to often make it difficult to determine whether the space upon which the shot is expected to fall at the greater distances is clear of vessels. The interference of all kinds of craft with ranging work is one of the difficulties which we have of late years experienced at the proving ground, and which limits its usefulness considerably. However, the 5-inch breech-loading rifle has been ranged this year, both for 2,000 feet muzzle velocity and for 1,700 feet, while the 8-inch gun has been ranged for 1,700 feet.

Much attention has been given by the officers at the proving ground to the settlement of questions regarding the service of the new armament under the conditions prevailing on shipboard, the working of carriages, gas checks and primers, the investigation of the difficulties liable to arise in service with all ordnance material, and the means of correction. In this connection all the forms of exercise and drill for the new guns, gotten up by the Bureau, have been practically tried at the proving ground and corrected and amended as experience there showed to be necessary.

In connection with the test of guns and carriages an ingenious instrument has been devised at the proving ground for registering the velocity and acceleration of the recoil of guns. This instrument was devised by Lieutenant Knight and has been importantly modified by Ensign Dashiell.

It is not unlikely that a change in the location of the proving ground may take place ere long. The difficulties of ranging guns at that place and its somewhat inconvenient situation for general work make a change desirable, and the Bureau has been for some time considering the question of another location. A conclusion will be reached in this matter as soon as we have full information on all the points involved.

The money appropriated ($40,000) for the purchase of a new proving ground, etc., has not yet been used.

TORPEDO TRIALS.

The Torpedo Board provided for in the act of Congress approved August 3, 1886, has been in session from time to time during the year examining plans and torpedoes which have been presented by various parties. The Bureau's instructions to the Board were printed in the appendix of last year's report, page 279, and have not since been changed. The following persons and firms have appeared before the Board this year:

J. N. H. Patrick, whose torpedo has been subjected to a series of trials not yet finished; M. E. Hall, whose torpedo has had a preliminary trial; and Dana Dudley, whose aerial torpedo and torpedo gun have been exhibited before the Board.

The report of the Torpedo Board will be found in the appendix, page 219.

THE HOWELL TORPEDO.

On August 4, 1888, the Navy Department decided to order from the Hotchkiss Ordnance Company thirty Howell torpedoes, with the right to extend the order to fifty under certain conditions.

The above-mentioned company, having acquired all the rights of late Howell Torpedo Company, has established a machine-shop Providence, R. I., where it has commenced the manufacture of Howell torpedo. The company's proposition to the Department contemplates specific performance by the torpedoes and a thoroughly cient weapon and launching apparatus in order to acceptance.

INSTRUCTION OF ENLISTED MEN.

This instruction has continued during the past year, two courses being given to continuous-service men; one in mechanical work at navy-yard, Washington; the other in torpedo and electrical work the Torpedo Station, Newport, R. I. A considerable number of continuous-service men of the Navy have gone through these cou and as a rule acquitted themselves very creditably.

It will soon be necessary to extend this instruction and to assign it a greater number of the men of the Navy than is now done, as progress of ordnance material renders it more important every year t a large number of the men of the service should have a practical worl acquaintance with the elaborate mechanisms that they are called up to handle.

In addition to the special instruction which is now given the Bu is about to establish a brief course in naval gunnery, which must be given at the Torpedo Station, as no proper or convenient spot for firing of guns exists at the navy-yard, Washington.

No opportunity has yet occurred for the Department to order the systematic ordnance instruction of the crews of ships newly commissioned on the lines indicated in the last report of the Bureau; but such instruction is absolutely essential and will no doubt be inaugurated by the Department as soon as matters can be so arranged.

SUBMARINE BOAT.

The Department's advertisement and circular inviting proposals for a submarine boat were issued in November last. Proposals for two designs of boats were received from William Cramp & Sons, of Philadelphia. One of these designs was of the type ordinarily known as the "Nordenfeldt," the other was the design known as that of the "Nautilus Submarine Boat Company" of New York. Both of these were interesting and possessed certain points of advantage; but as neither of the proposals contained any guaranty of performance on the part of the boats of the functions required by the Department, the proposals were rejected.

The Department has since issued a new advertisement and circular again inviting the submission of proposals for submarine boats. The time of opening the bids is fixed for the 4th of January next.

TORPEDO-BOAT.

The steel sea-going torpedo-boat provided for by act of Congress approved August 3, 1886, was advertised in the usual way, and proposals were received from the Herreshoff Manufacturing Company, of Bristol, R. I., and the Vulcan Iron Works, of Chicago, Ill.

The proposal of the Herreshoff Manufacturing Company was accepted. A contract based upon the proposal was entered into, and the

oat is now in process of construction at the works of the Herreshoff Company, at Bristol. Plans of this boat will be found in the appendix.

THE STEAMER STILETTO.

The purchase of the *Stiletto* was authorized by act of Congress approved March 3, 1887, and the boat was turned over by the Herreshoff Manufacturing Company, her owners, in June last. She has been used at the Torpedo Station for exercising the officers and men of the Navy under torpedo instructions there, and is reported as having been very useful.

THE WORKING OF GUNS AND CARRIAGES BY PNEUMATIC PRESSURE.

During the past year the Department has contracted with the Pneumatic Gun Carriage and Power Company for the construction of an 8-inch gun carriage working by pneumatic pressure; and for pneumatic machinery and apparatus for working the 10-inch guns of the monitor *Terror*, and also for turning her turrets, steering, and maintaining on board a cold-room for refrigerating purposes.

Work under these contracts is now being prosecuted at the works of the South Boston Iron Company, Boston, Mass., that part of the contract relating to turning turrets, steering, and refrigerating being under cognizance of the Bureau of Construction and Repair.

STEEL CAST GUNS.

Pursuant to an act of Congress approved March 3, 1887, the Department issued an advertisement inviting proposals for the furnishing of three steel cast high-power guns of 6-inch caliber, one to be of Bessemer, one of open-hearth, and one of crucible steel.

Two proposals were received in answer; one from Pittsburgh Steel Casting Company for a gun of Bessemer steel, and one from the Standard Steel Casting Company for a gun of open-hearth steel. No proposal was received for furnishing a gun of crucible steel.

The two proposals were accepted and contracts made with the companies, each of which furnished a rough-bored and turned gun casting of the proposed kind, which was sent to the ordnance department of the navy-yard, Washington, to be finished. The gun of the Pittsburgh Steel Casting Company was received first, and has been machine-finished and sent to the Naval Ordnance Proving Ground, where it will be speedily tried. The gun of the Standard Steel Casting Company was received subsequently; it may now be said to be virtually finished, and will be shipped very shortly to the proving ground. Drawings of these guns will be found in the appendix.

In the case of these guns bidders were invited to submit their own designs, the only details fixed by the Bureau being the caliber of the guns (6 inches), the weight of the projectile (100 pounds), and the muzzle velocity (2,000 feet per second). These data were given in pursuance of the act of Congress, which required that the guns should be 6-inch, high-power, breech-loading rifles.

Each of the companies established the external form of its gun. They, however, both adopted the powder-chamber, the rifling, and the breech mechanism of the Bureau's 6-inch rifle, Mark II.

TORPEDO STATION.

The torpedo station at Newport, R. I., has continued during the year under the superintendence of Commander C. F. Goodrich, U. S. Navy,

The above-mentioned company, having acquired all the rights of the late Howell Torpedo Company, has established a machine-shop at Providence, R. I., where it has commenced the manufacture of the Howell torpedo. The company's proposition to the Department contemplates specific performance by the torpedoes and a thoroughly efficient weapon and launching apparatus in order to acceptance.

INSTRUCTION OF ENLISTED MEN.

This instruction has continued during the past year, two courses being given to continuous-service men; one in mechanical work at the navy-yard, Washington; the other in torpedo and electrical work at the Torpedo Station, Newport, R. I. A considerable number of the continuous-service men of the Navy have gone through these courses, and as a rule acquitted themselves very creditably.

It will soon be necessary to extend this instruction and to assign to it a greater number of the men of the Navy than is now done, as the progress of ordnance material renders it more important every year that a large number of the men of the service should have a practical working acquaintance with the elaborate mechanisms that they are called upon to handle.

In addition to the special instruction which is now given the Bureau is about to establish a brief course in naval gunnery, which must be given at the Torpedo Station, as no proper or convenient spot for the firing of guns exists at the navy-yard, Washington.

No opportunity has yet occurred for the Department to order the systematic ordnance instruction of the crews of ships newly commissioned on the lines indicated in the last report of the Bureau; but such instruction is absolutely essential and will no doubt be inaugurated by the Department as soon as matters can be so arranged.

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TORPEDO STATION.

The torpedo station at Newport, R. I., has continued during the year under the superintendence of Commander C. F. Goodrich, U. S. Navy,

inspector of ordnance, in charge, whose progressive ideas and extremely efficient management have resulted in very important progress.

With the money appropriated for the purpose the principal wharf at the station, with the float and ferry landing, has been repaired, renewed where necessary, and put in good order.

The electrical laboratory has been extended, and is now large enough to permit lectures and practical exercises to go on in it at the same time, besides affording sufficient space for the other necessary work connected with so useful an establishment. This laboratory is now capable of conducting all the most important forms of electrical work and research, and may be considered as being equipped in an entirely satisfactory manner for investigation connected with the application of electricity to naval purposes.

The station now receives water from the city of Newport by a main running across the harbor.

Much progress has been made upon the sea-wall, which was authorized to be extended by Congress. This latter work, however, is a somewhat extensive undertaking, and will probably require a further appropriation to complete it satisfactorily.

GUN-COTTON FACTORY.

The gun-cotton factory has from time to time been in operation as supplies of this explosive were required. The product has been very materially cheapened since the factory was started, the cost of the acids having been very much reduced, and as the supply of cotton-waste is now about exhausted it is proposed to experiment with a cheaper kind, which, if thoroughly satisfactory, can be used in future production.

It is thought that efforts should be made to interest some private firms at a distance from the Atlantic sea-board, and especially in one of the Pacific States, in the production of gun-cotton for military purposes. Doubtless there may be some difficulty in enlisting any firm in this undertaking, but it would be very advantageous in time of war if some additional source of supply to the factory at the torpedo station could be relied upon.

The Bureau has satisfactorily demonstrated the practicability of using compressed wet gun-cotton as a charge for projectiles fired from service powder-guns of caliber as high as that of the 80-pounder inclusive, and has also fired several rounds from the 6-inch built-up steel gun, with a muzzle velocity of about 1,700 feet per second. It has not, however, thus far been practicable to utilize a suitable gun for the extension of these experiments. There is no doubt, however, that gun cotton can be used as the charge of high-power shells, the difficulty of its service application lying entirely in the want of a safe and proper fuze for its detonation on penetration of the target. No thoroughly satisfactory fuze for this purpose has yet been devised. On the whole, gun-cotton still holds its own as the most generally useful and safe of the military explosives.

The usual supply of service torpedo outfits for ships and boats has been manufactured and issued as occasion required.

The service electrical lamp for submarine work has been completed and is now on issue to ships. Its candle power is 150. Its voltage is variable, depending upon that of the ship's lighting plant.

The Bureau has made arrangements for securing torpedo search-light apparatus of American manufacture, including engines, dynamos, projectors, etc. This is a most important matter, and the details of it have been arranged by the torpedo station.

A boat and field telephone kit for military communication between ships and boats or landing parties has been perfected and will be issued to service. The advice of the American Bell Telephone Company has been received in the prosecution of this work and is highly appreciated.

The Department's action in ordering a board to report upon the proper voltage of the dynamos of the Navy is regarded by this Bureau as having been a very important step in organization, and if the report of the board be adopted doubtless the uniformity resulting will be most advantageous.

The Bureau has lately directed the torpedo station to devise a suitable electrical firing apparatus to be used in connection with the Bureau's electrical primers for firing great guns. It is thought that one or two small service-firing cells with power sufficient to afford a current suitable for firing primers can be attached to the belt of the gun captain or be placed upon the slide of the gun-carriage (preferably the former). Such an apparatus would perhaps in the end supplant the spring-lock as the ordinary means of firing guns, as its application would disturb the aim of the gun captain less than the pulling of the lock lanyard now does.

Experiments were made in this direction some years since by the Bureau, using various forms of the secondary (or storage) battery, but the incomplete state of development which the secondary battery had reached at the time prevented much progress being made. It is thought that the service cell on the whole offers more advantages as a source of electricity for this purpose.

In the new vessels the Bureau will introduce a circuit for the simultaneous electrical firing of the main battery. It is intended to take the current from the lighting circuit for this purpose.

CHEMICAL LABORATORY.

The chemical work of the torpedo station is very extensive and is constantly increasing. The researches with regard to modern explosives come principally under this head, and are absolutely necessary, not only in order to enable the Bureau to keep abreast of the times in this most important branch of naval warfare, but also in order that the nature and value of the new explosives as they come forward may be ascertained as soon as may be and a correct opinion formed as to their efficiency, foreign nations sometimes assuming great effectiveness for new explosives which they may have discovered or adopted, the capabilities of which on examination are found to be not as great as was announced.

The properties of all explosive substances known in the market, or such as can be manufactured by us from the raw material, should be studied in order to a determination of their real value in warfare.

The Bureau has within the last year required the chemical laboratory to analyze a number of specimens of steel and other metals used in current ordnance manufacture, and the facilities of the laboratory are now being extended so as to make it still more useful in this direction.

In this connection numerous interesting and valuable experiments have been made with a view to determining the comparative physical value of metals by means of their resistance to the shock due to the detonation of determined amounts of explosives. This kind of shock-test seems to promise very instructive and valuable results, and the work in this direction is being pursued.

Commander Goodrich reports that the torpedo-boat *Stiletto*, purchased last summer by the Department for the use of the station, has been of great value for the purposes of exercise and instruction, and the advent of the first-class steel sea-going torpedo-boat which is now being built for the Department by Messrs. Herreshoff will be a m welcome addition to the plant of the station for the practical instruction of classes of officers and men in the management of torpedo-boats. This branch of our profession is a specialty and can only be learned by persistent practice.

INSTRUCTION.

The usual class of officers received instruction in the branches bearing upon torpedo warfare at the station last summer. The course was made as practical as possible, and, as a rule, the attention shown and the progress made by the officers was very satisfactory. The course extends over only three months of time, which of course is inadequate to the end in view; but probably no more time could be afforded at present, and it has certainly been very efficiently employed.

A few officers were selected for what is known as the advanced or longer course of instruction. They acquitted themselves well, and their value to the service will be greatly increased in consequence of their comparatively extended knowledge of the branches in which they were instructed.

The general course of instruction was enlarged this year, and the number of lecture topics increased. The schedule of the course will be found in the report of Commander Goodrich in the appendix, page 203; and its comparison with that of previous years will show the progress made.

At the conclusion of the course the officers were required to write theses in solution of certain tactical problems submitted to them. The papers as a rule were creditable, and some of them were decidedly valuable. The list of subjects will be found in the appendix.

Practical instruction in electricity was more extended than in previous years, and as much practice as possible was given to the classes the management of dynamos, lighting circuits, and all the electrical apparatus used on shipboard.

The class of officers and also those attached to the torpedo station had the very great advantage of hearing a course of lectures delivered by distinguished specialists on electrical subjects. The Department is greatly indebted to these gentlemen for the trouble they took to prepare and to deliver these lectures, which were of great value to those who listened to them. The following lectures were delivered:

Incandescent lamps, by Mr. John Howell, of the Edison Lamp Company.

The development of the dynamo, by Professor Elihu Thomson, of the Thomson-Houston Electric Company.

Practical systems of electrical telegraphy, by Mr. William Maver, jr., of the Western Union Telegraph Company.

Electrical motors, by Mr. Frank J. Sprague, of the Sprague Electric Railway and Motor Company.

The Department has thanked these gentlemen individually for the interest in the advancement of the Navy that they have shown by their willingness to instruct officers in these most important branches.

The board on experiments at the torpedo station was organized by the Bureau some years since to facilitate progress in researches with regard to the material of torpedo warfare. This board has done excel-

t work within the past year and has handed in solutions of several important practical topics, a list of which will be found in the report of Commander Goodrich in the appendix.

Commander Goodrich calls attention to the necessity of extending at t torpedo station the facilities for the care and preservation of torpedo b s. To this end it will be necessary to construct a proper marine rw and covered boat-house, so that torpedo boats may be hauled up out of water and stowed under shelter during the winter, and at such times as they are undergoing repairs or are not in use. Such an establishment is a necessity if we are to have torpedo boats, and in this year's estimates the Bureau has asked for a sum of money for the partial erection of such a building, etc.

The staff of the torpedo station, though inadequate for the purposes in view, is of the very best quality, and has supported the inspector in charge most efficiently and intelligently during the year.

The following statements are appended, viz:

—Statement showing the amount appropriated under each specific head of appropriation for the service of the Bureau of Ordnance during the fiscal year ending June 30, 1888, expenditures during the same period, and balance remaining on hand June 30, 1888.

B.—Statement of the number of days' labor and cost thereof, from July 1, 1887, to June 30, 1888, at the respective navy-yards and stations, chargeable to the Bureau of Ordnance.

C.—Amounts expended during the fiscal year ending June 30, 1888, from the appropriations under the Bureau of Ordnance, for civilians employed on clerical duty, or in any other capacity than as ordinary mechanics and workingmen.

D.—Abstract of offers for furnishing supplies, and which were contracted for by the Bureau of Ordnance during the fiscal year ending June 30, 1888, noting contracts awarded thereon.

The officers attached to the Bureau are well known to the Department for their high intelligence and industry, and they have been of the greatest assistance in the preparation and prosecution of the important work that has been from time to time committed to them.

Commander A. H. McCormick, U. S. Navy, has been for the last three years inspector of ordnance at the Washington navy-yard. His term of duty at that station has just expired, and the Bureau desires to record its high appreciation of his services and efforts while occupying that most difficult and responsible post.

The clerical force of the Bureau has performed its duties with intelligence and zeal.

I am, sir, your obedient servant,

MONTGOMERY SICARD,
Chief of Bureau.

Hon. WILLIAM C. WHITNEY,
Secretary of the Navy.

A.—*Statement showing the amount appropriated under each specific head of appropriation for the service of the Bureau of Ordnance during the fiscal year ending June 30, 1888, expenditures during the same period, and balance remaining on hand June 30, 1888.*

Appropriation.	Appropriated.	Expended.	Balance June 30, 1888.
Ordnance	$126,400	$101,763.68	$24,636.32
Repairs ordnance	15,000	13,859.66	1,140.34
Civil establishment	24,525	24,200.56	324.44
Contingent ordnance	5,000	4,999.04	.96
Torpedo corps	57,000	49,009.78	8,790.22
	228,725	193,832.72	34,892.28

The amounts expended were *—

For labor	$126,267.27
For material, etc	67,565.45
	193,832.72

The balances remaining are all needed to meet outstanding obligations or future requirements, except the balance under "Civil establishment."

B.—*Statement of the number of days' labor and cost thereof from July 1, 1887, to June 1888, at the respective navy-yards and stations chargeable to the Bureau of Ordnance.*

Navy-yards, etc.	Number of days' labor.	Cost of same.
Portsmouth	1,405	$3 [illegible]
Boston	1,096	2 [illegible]
New York	9,250	22,[illegible]95
League Island	594	1,278.00
Washington	178,088	408,686.21
Norfolk	3,928	8,07[illegible].38
Pensacola	313	480.00
Mare Island	2,469	6,093.51
Key West, Fla	31	75.00
Naval ordnance proving ground	11,248	14,17[illegible]
Torpedo station	10,324	2[illegible],24[illegible]
	218,740	†495[illegible]45

* Exclusive of expenditures from special appropriations, new steel cruisers, etc.
† Includes labor on the new steel cruisers, etc.

C.—*Amounts expended during the fiscal year ending June 30, 1888, from the appropriations under the Bureau of Ordnance, for civilians employed on clerical duty, or in any other capacity than as ordinary mechanics and workingmen.*

Navy-yard.	Rating.	Amount paid.
Portsmouth	1 writer (6 months)	$498.85
Boston	1 writer (3 months)	238.00
New York	1 clerk	1,400.00
Washington	1 clerk	1,600.00
	1 writer	1,017.25
	1 writer	1,017.25
	1 copyist	720.00
	1 copyist	720.00
	1 telegraph operator	900.00
	1 draughtsman	1,544.98
	1 draughtsman	1,081.00
	1 draughtsman	1,078.04
	1 draughtsman	1,021.77
	1 assistant draughtsman	772.00
	1 foreman	2,156.00
	1 draughtsman (5 months)	585.00
	1 assistant draughtsman	660.00
	1 assistant draughtsman (197½ days)	359.75
	1 writer (177½ days)	433.75
	1 special hand (10 days)	20.00
	1 toolkeeper and ordnance man	657.60
	1 electrician (1½ days)	6.00
	1 quarterman machinist	1,281.50
	1 quarterman machinist	1,074.54
	1 quarterman machinist	1,115.84
	1 quarterman molder	1,183.63
	1 quarterman machinist (20 days)	66.00
	1 quarterman blacksmith (7 months)	717.06
	1 leadingman pattern-maker	1,097.25
	1 leadingman laboratorian	1,050.00
	1 coppersmith in charge of rolling-mills (105⅝ days)	528.13
	1 superintendent, new construction	3,253.75
	1 leading joiner	1,155.90
	1 quarterman laborer	719.09
	1 quarterman laborer	922.72
	1 foreman laborer (3¾ days)	11.37
	1 leading painter (2⅛ days)	8.20
	1 leading brickmason (108½ days)	518.42
	1 draughtsman (121 days)	423.50
	1 draughtsman (252 days)	882.00
	1 writer	669.50
Norfolk	1 clerk	1,200.00
Mare Island	1 writer	943.16
Naval Ordnance Proving Ground.	1 writer	1,017.24
Torpedo Station	1 chemist	2,500.00
	1 clerk	1,200.00
	1 draughtsman	1,500.00
	Total	43,526.04

D.—*Abstract of offers for furnishing supplies and which were contracted for by the Bureau of Ordnance during the fiscal year ending June 30, 1888, noting contracts awarded thereon.*

Navy-yard, Washington, D. C. (Under advertisement dated June 4, 1887.)

Cement:	
J. M. Wheatley	$2,890.00
*J. M. Wheatley	2,290.00
J. M. Wheatley	3,115.00
George L. Neville	3,785.00
John Miller	3,815.00
Broken stone:	
Andrew Neville	3,300.00
Andrew Neville	3,600.00
H. P. Gilbert	3,360.00
* E. E. Barnes	2,760.00
George L. Neville	36,000.00
A. J. Howell	4,180.00
A. J. Howell	4,356
John Miller	3,600
Sand:	
Andrew Neville (at wharf)	900.00
Andrew Neville (at building)	1,012.50
E. E. Barnes	1,125.00
George L. Neville	7,500.00
*John Miller (sample No. 1)	1,012.50
John Miller (sample No. 2)	825.00
Piles:	
L. A. Clarke	846.00
Church & Stephenson	1,800.00
Wheatley Bros	1,440.00
Wheatley Bros	1,800.00
George L. Neville	1,206.00
* W. W. McCullough	792.00
D. A. Gillies	900.00
Nails, zinc, and shutter pivots:	
J. B. Randall	332.16
* Robert Boyd	303.36
Glazing:	
*Arthur E. Rendle	4,000.00
Georgia yellow pine.	
Willet & Libbey	494.25
Church & Stephenson	397.17
Wheatley Bros	485.43
William D. Gill	485.43
*George L. Neville	441.30
W. W. McCullough	441.30
John Miller	550.56
Pine lumber:	
*Willet & Libbey	4,394.83
Church & Stephenson (informal)	4,099.97
Wheatley Bros	4,675.17
William D. Gill	5,357.75
George L. Neville	4,690.25
W. W. McCullough	4,620.17
John Miller	5,488.23

Navy-yard, New York (bids invited September 14, 1887).

Repairs at Ellis Island, New York.	
*Henry DuBois' Sons	2,895.18
M. Engle & Co	3,000.00
O'Connell & Coffey	4,890.00
John W. Flaherty	3,050.00
Cofrode & Evans	7,120.00

* Awarded.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1890, by the Bureau of Ordnance, Navy Department.

Detailed object of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Total amount to be appropriated under each head of appropriation.	Amount appropriated for the current fiscal year ending June 30, 1889.
SALARIES.			
Chief clerk (July 11, 1888, R. S., p. 70, sec. 416)	$1,800.00		
Draughtsman (same acts)	1,800.00		
One assistant draughtsman (July 11, 1888)	1,400.00		
One clerk of class three (July 11, 1888, R. S., p. 27, sec. 167)	1,600.00		
One clerk of class two (same acts)	1,400.00		
One clerk of class one (July 11, 1888)	1,200.00		
One clerk at $1,000 (July 11, 1888)	1,000.00		
One copyist (July 11, 1888)	900.00		
One assistant messenger (July 11, 1888, R. S., p. 27, sec. 167)	720.00		
One laborer (same acts)	660.00		
Increase submitted:—			
To salary of chief clerk (submitted)	450.00	$12,930.00	$12,480.00
ORDNANCE AND ORDNANCE STORES.			
For procuring, producing, preserving, and handling ordnance material; for the armament of ships; for fuel, tools and material, and labor to be used in the general work of the Ordnance Department; for furniture at magazines, at the Ordnance Dock, New York, and at the Naval Ordnance Battery and Proving Ground, and for prizes to enlisted men for excellence in ordnance exercise and target practice (September 7, 1888)		130,000.00	
For proof of naval armaments (September 7, 1888)		6,000.00	
For new wharf and approaches at Craney Island, Norfolk Harbor (submitted)		5,000.00	
NOTE.—The old wharf is badly decayed and worn; and from the filling in of channel is accessible only at high water. It will require at least $5,000 to dredge a channel, which from its location will fill in with mud almost as fast as it is removed. It is therefore recommended that the old wharf be abandoned, and a new wharf built further out, the end to be in deeper water.			
Main and secondary batteries complete, of the new types, for two of the ships now in service (submitted)		222,500.00	
Towards the general armament of the Navy with modern secondary batteries and small-arms:			
24 machine cannon of modern caliber (submitted)	74,400.00		
10 musket caliber machine guns (submitted)	27,500.00		
1,000 magazine rifles, equipments, and ammunition (submitted)	34,750.00		
400 naval cadet magazine rifles (submitted)	6,000.00		
One steel shell lighter of about 68 tons displacement, with carrying capacity of about 45 tons (submitted)	8,000.00	514,150.00	253,000.00
NOTE.—The above lighter is required for carrying shells from the magazine, Ellis Island, New York, to and from ships and the navy yard.			
REPAIRS ORDNANCE.			
Necessary repairs to ordnance buildings, magazines, gun parks, boats, lighters, wharves, machinery, and other objects of the like character (September 7, 1888)		15,000.00	15,000.00
TORPEDO CORPS.			
Labor, material, freight and express charges; general care of and repairs to grounds, buildings, and wharves; boats; instruction; instruments, tools; furniture; experiments, and general torpedo outfits (September 7, 1888)	60,000.00		
NOTE.—The torpedo station has developed very rapidly within the past few years, necessitating a somewhat larger appropriation for current purposes. The sum usually granted ($50,000) is too small. It should in justice to the work be increased to $60,000.			
For enlarging torpedo-boat house to receive the *Stiletto*, and other torpedo boats (submitted)	5,000.00		
For torpedo-boat marine railway (submitted)	5,000.00	70,000.00	65,700.00
NOTE.—The two preceding items are imperatively necessary for the preservation of torpedo boats.			

Estimates of appropriations required for the service of the fiscal year, etc.—Continued.

Detailed object of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Total amount to be appropriated under each head of appropriation.	Amount appropriated for the current fisc year end— June 30, 1
CONTINGENT, ORDNANCE.			
Miscellaneous items, viz: Freight to foreign and home stations; advertising; cartage and express charges; repairs to fire-engines; gas and water pipes; gas and water tax at magazines; toll, ferriage, foreign postage, and telegrams to and from the Bureau (act Sept. 7, 1888)		$10,000.00	$5,
NOTE.—The usual amount ($5,000) appropriated under the above head is insufficient. A deficiency appropriation of $3,000 additional has just been made for the year 1887-'88, and it is found that a still further deficiency for that year will probably exist when all the accounts from foreign stations are in.			
CIVIL ESTABLISHMENT.			
Navy-yard Portsmouth, N. H.:			
One writer (act September 7, 1888)	$500.00		
Navy-yard, Boston, Mass.:			
One writer (same act)	500.00		
Navy-yard, New York:			
One clerk (same act)	1,400.00		
Navy-yard, Washington, D. C.:			
One clerk (same act)	1,800.00		
Two writers, at $1,017.25 each (same act)	2,034.50		
One draughtsman (same act)	1,800.00		
Three draughtsmen, at $1,081 each (same act)	3,243.00		
One assistant draughtsman (same act)	772.00		
One foreman (same act)	2,156.00		
Two copyists, at $720 each (same act)	1,440.00		
One telegraph operator (same act)	900.00		
Navy-yard, Norfolk, Va.:			
One clerk (same act)	1,200.00		
Navy-yard, Mare Island, Cal.:			
One writer (same act)	1,017.25		
Naval ordnance proving ground, Annapolis, Md.:			
One writer (same act)	1,017.25		
Torpedo station, Newport, R. I.:			
One chemist (same act)	2,500.00		
One clerk (same act)	1,200.00		
One draughtsman (same act)	1,500.00		
		24,980.00	24,525.
NOTE.—The above estimate increases the pay of the clerk ($200) and principal draughtsman ($255) at the Washington navy-yard. These are very laborious and responsible positions, and are filled by most efficient and excellent men, who should have the rate of pay estimated for.			
INCREASE OF THE NAVY.			
Armament.—Towards the armament, of domestic manufacture, for the vessels authorized by the act of March 3, 1885; of the vessels authorized by sections 1 and 2 of the act of August 3, 1886; of the unfinished monitors mentioned in section 3 of the same act; of the *Miantonomoh*; of the vessels authorized by the act approved March 3, 1887, and of the vessels authorized by the act approved September 7, 1888 (act Sept. 7, 1888)		4,077,000.00	2,000,000.0
Gun plant.—Amount required to complete the construction and equipment of the ordnance shops, offices, and gun plant at the Washington navy-yard—to be made available at once (submitted		625,000.00	
NOTE.—The above amount is required in addition to the sum appropriated for the purpose specified by section 8 of the act approved August 3, 1886.			

1888	July	1888	L' Conder

RIFLING

FOR

RK 3.– 6in. B-L-R.

of Ordnance, March 10th 1888.

171
1353

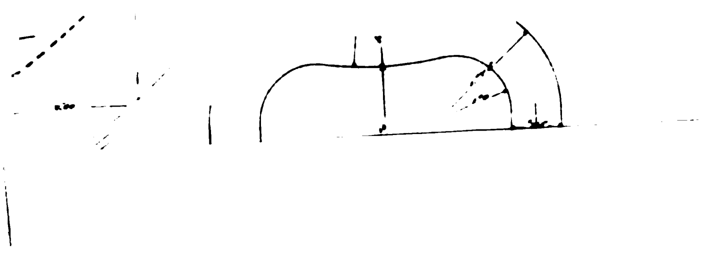
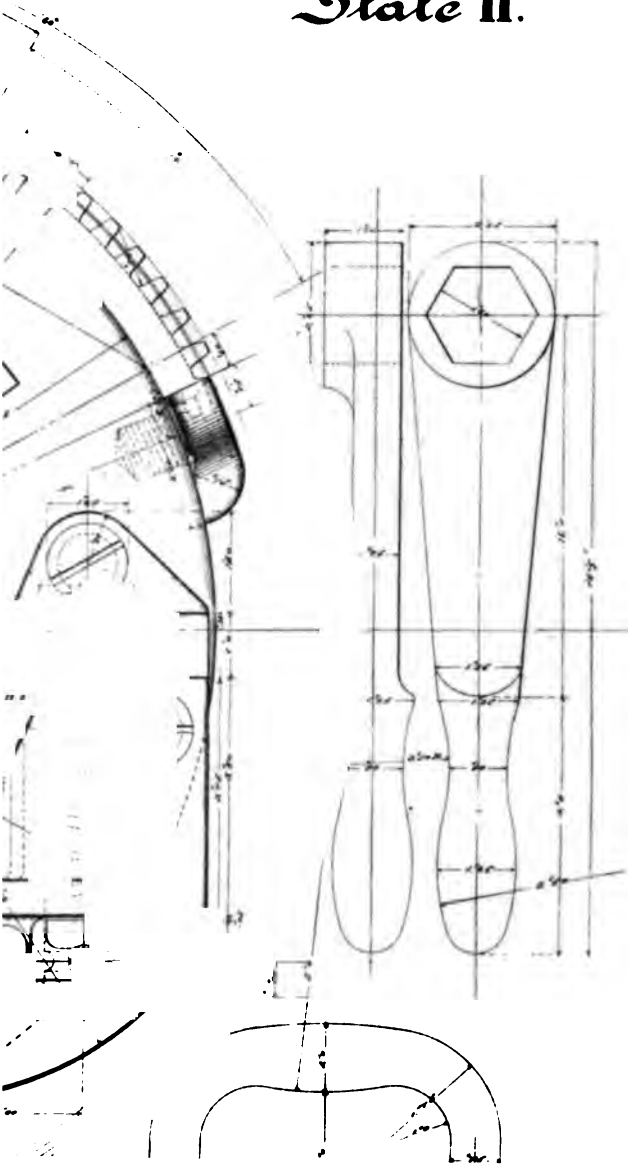
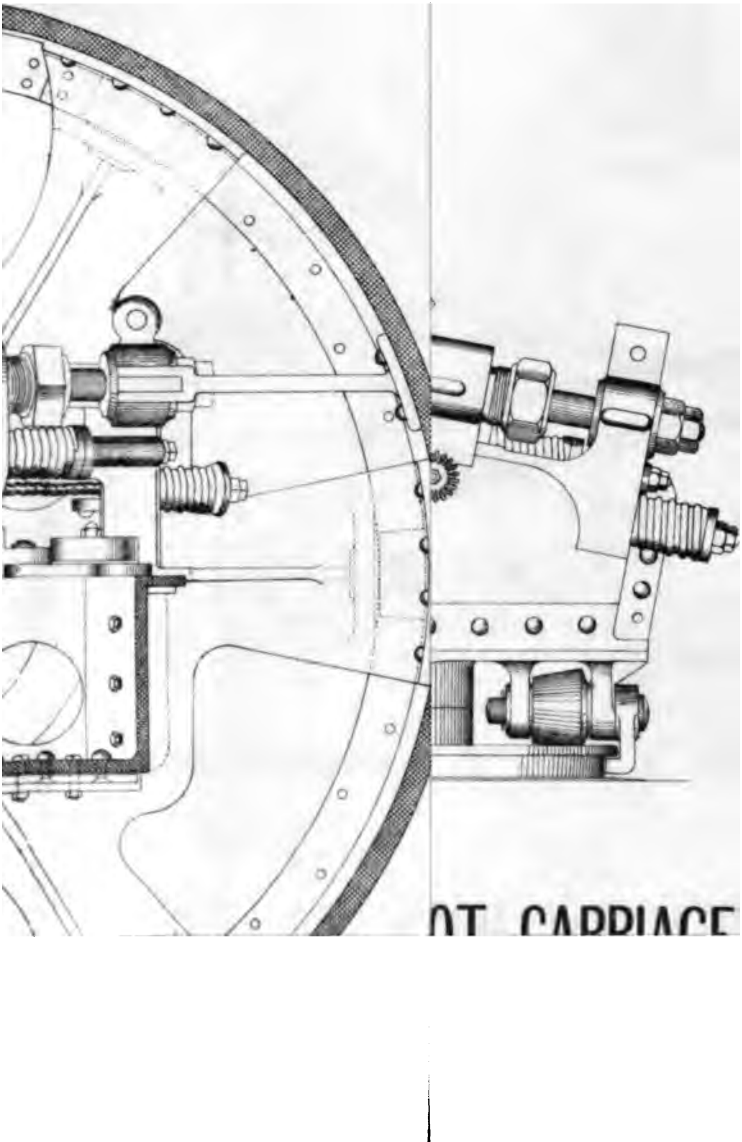


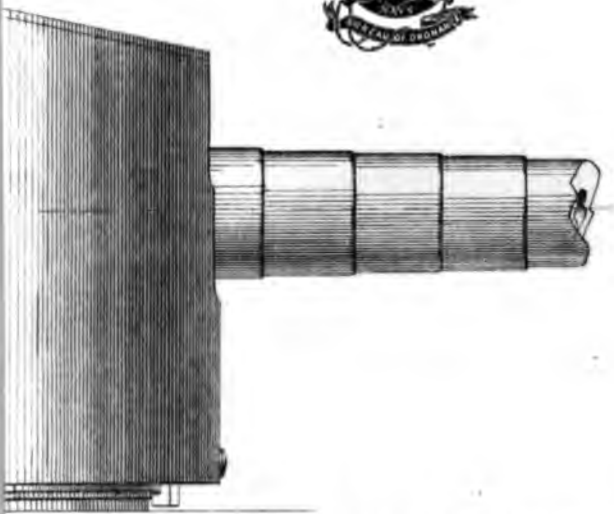
Plate II.





OT CARRIAGE

12



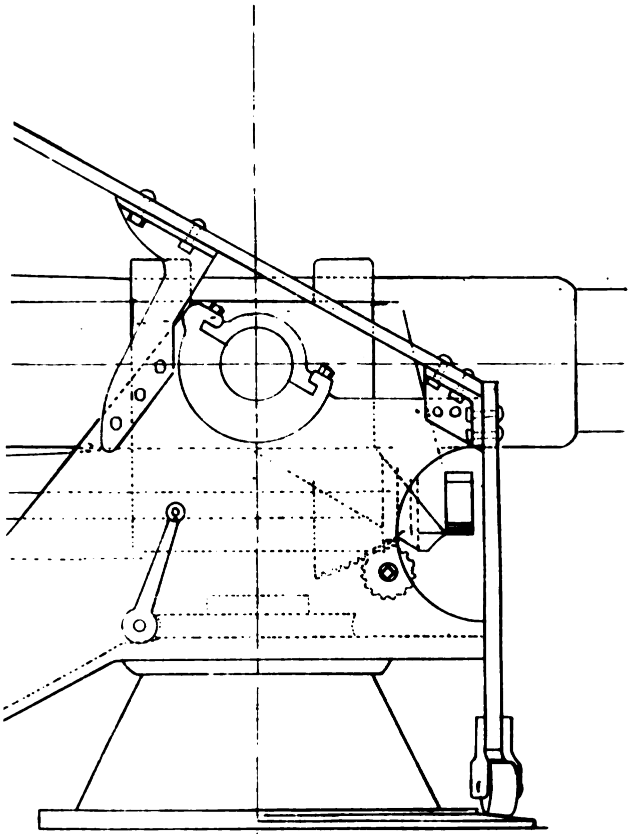
CENTRAL PIVOT CARRIAGE

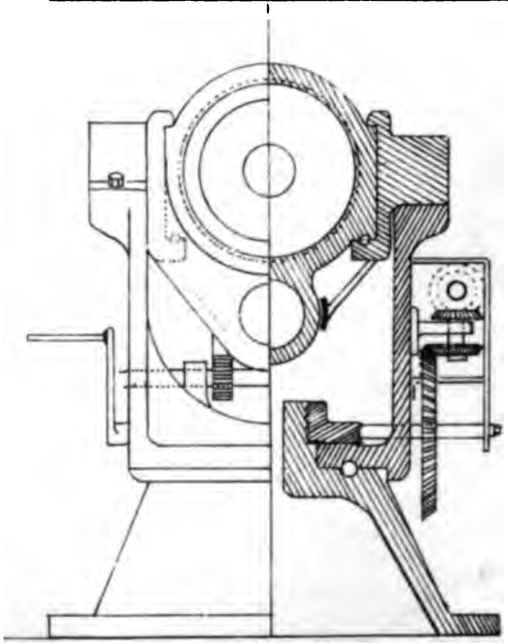
FOR

8-inch B. L. R.

FOR THE

U. S. S.^RS





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Electric

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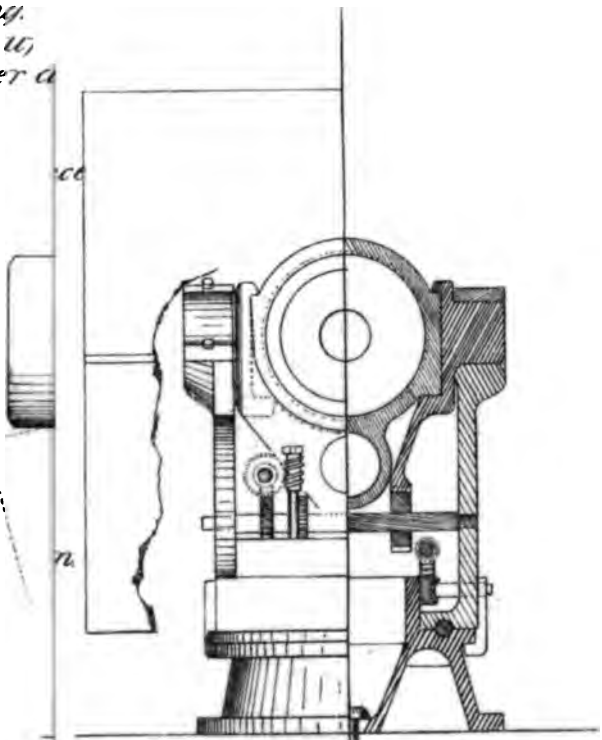
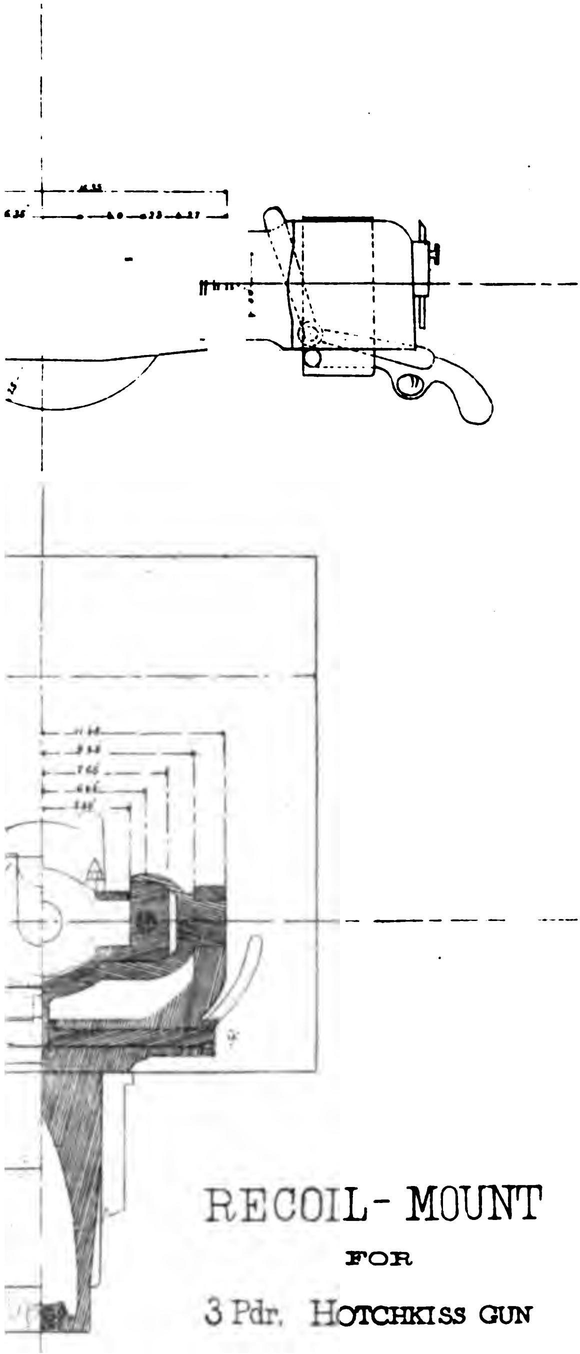
shoulder a



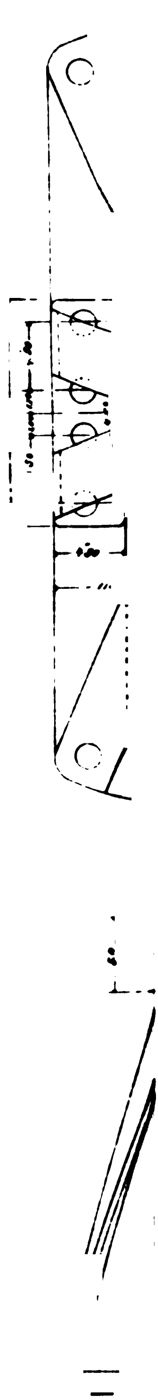
1461

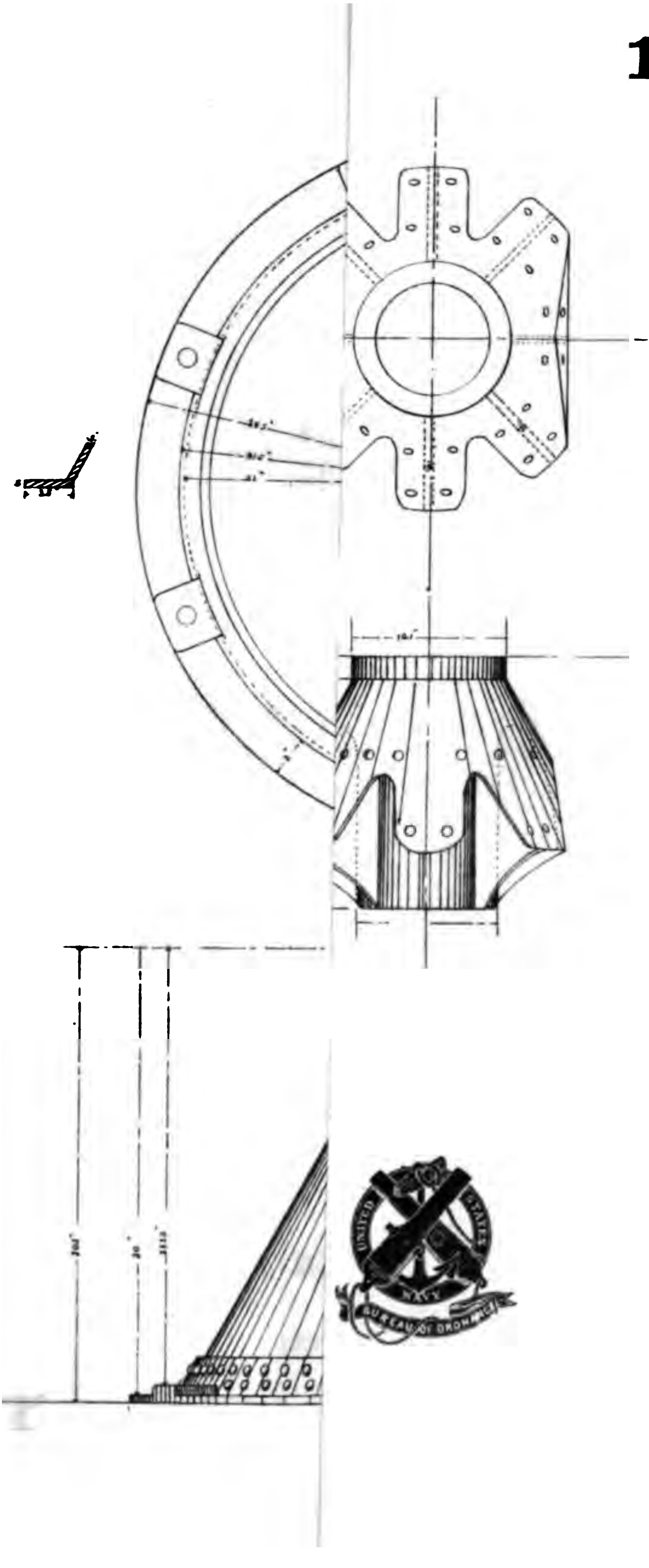


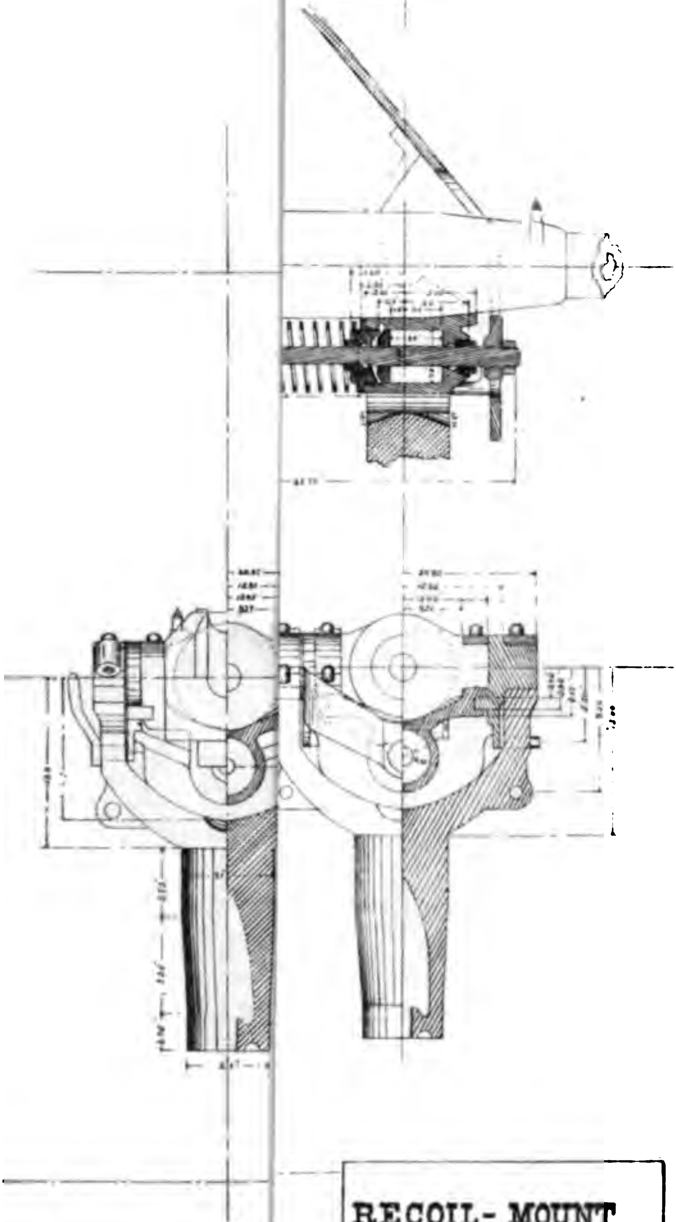
RECOIL-MOUNT

FOR

3 Pdr. HOTCHKISS GUN




UNITED STATES
NAVY
BUREAU OF ORDNANCE



RECOIL-MOUNT

FOR

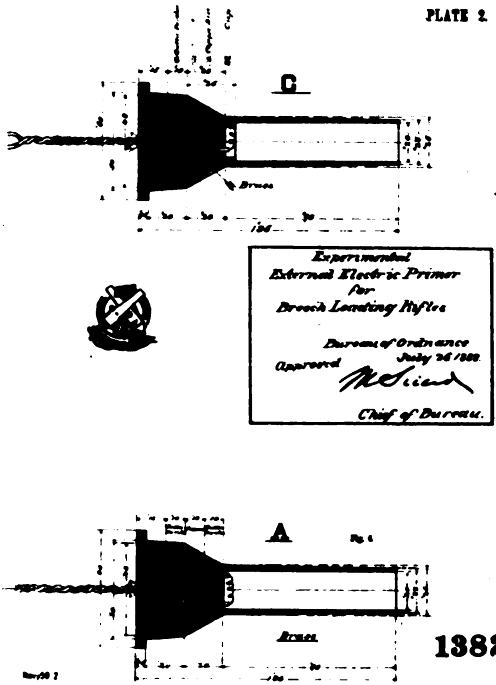
6 Pdr. HOTCHKISS GUN.

1383

NAVY REVOLVER.

(NEW DESIGN.)

PLATE 2.


C
Brass
Experimental
External Electric Primer
for
Breech Loading Rifles
Bureau of Ordnance
July 26 188
Approved
Chief of Bureau.
A
Brass

1382

Fig. 9.

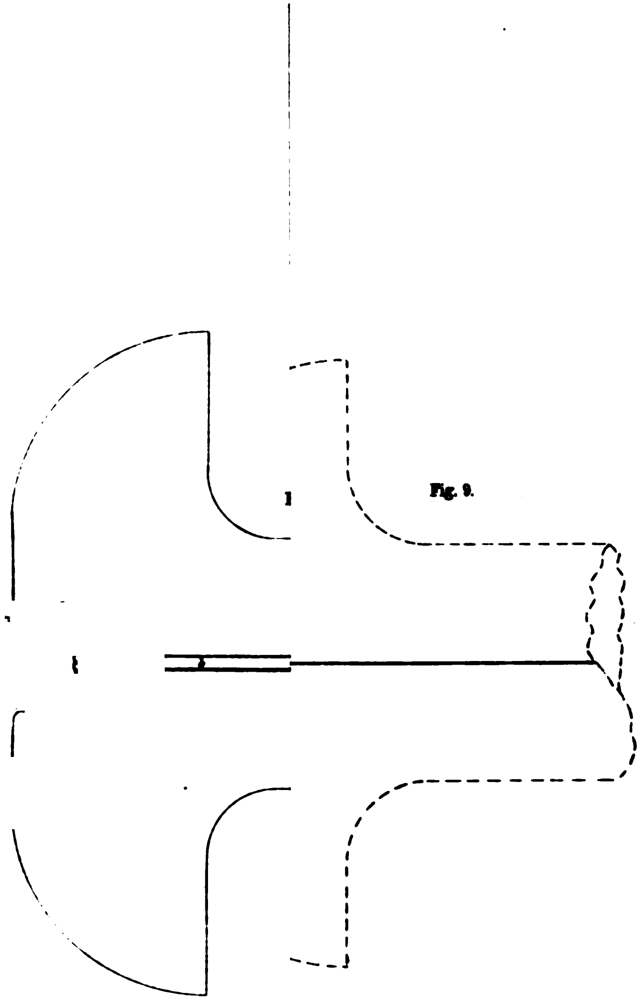
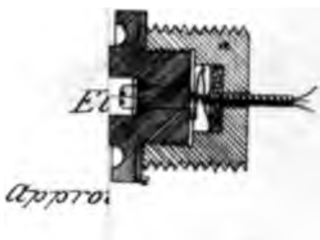


Fig. 10.



Navy50 2

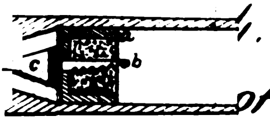
PLATE 1

-ntal

'on Primer

Fig. 7.

g Rifles.



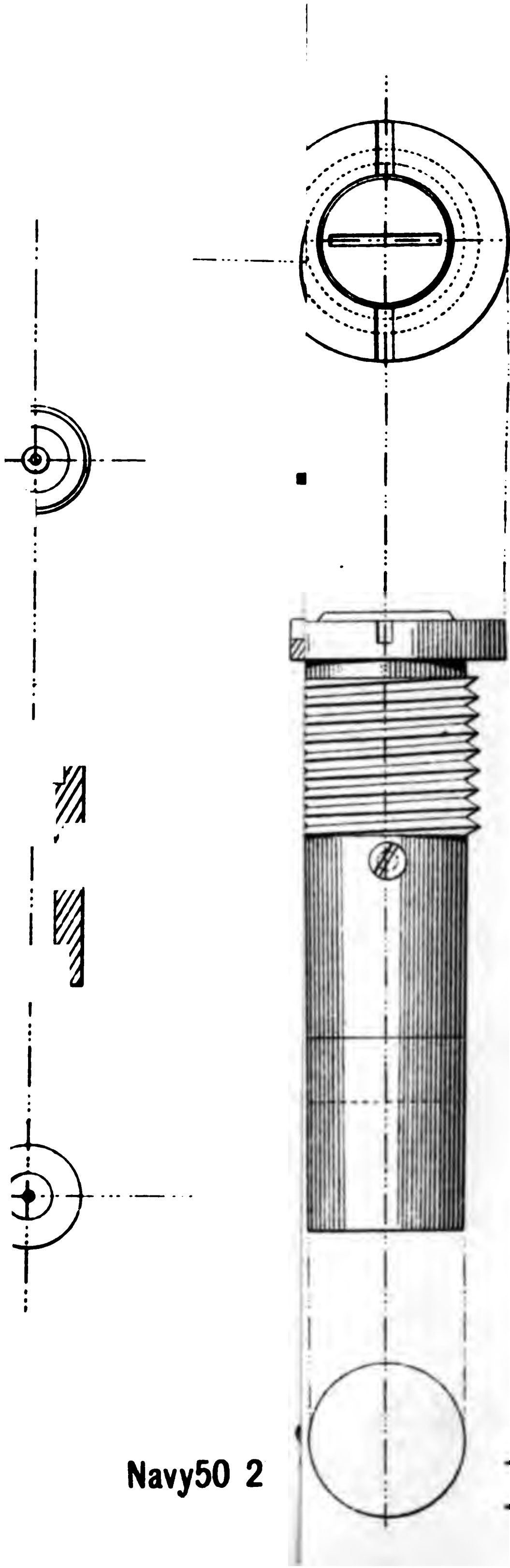
l.

of Ordnance

July 27. 1888.

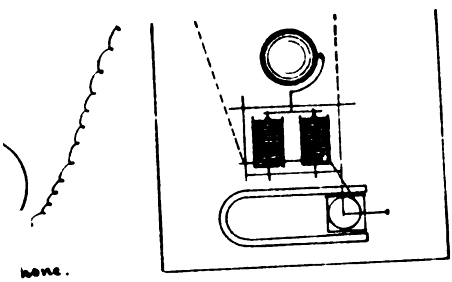
ef of Bureau.

1381



Navy50 2

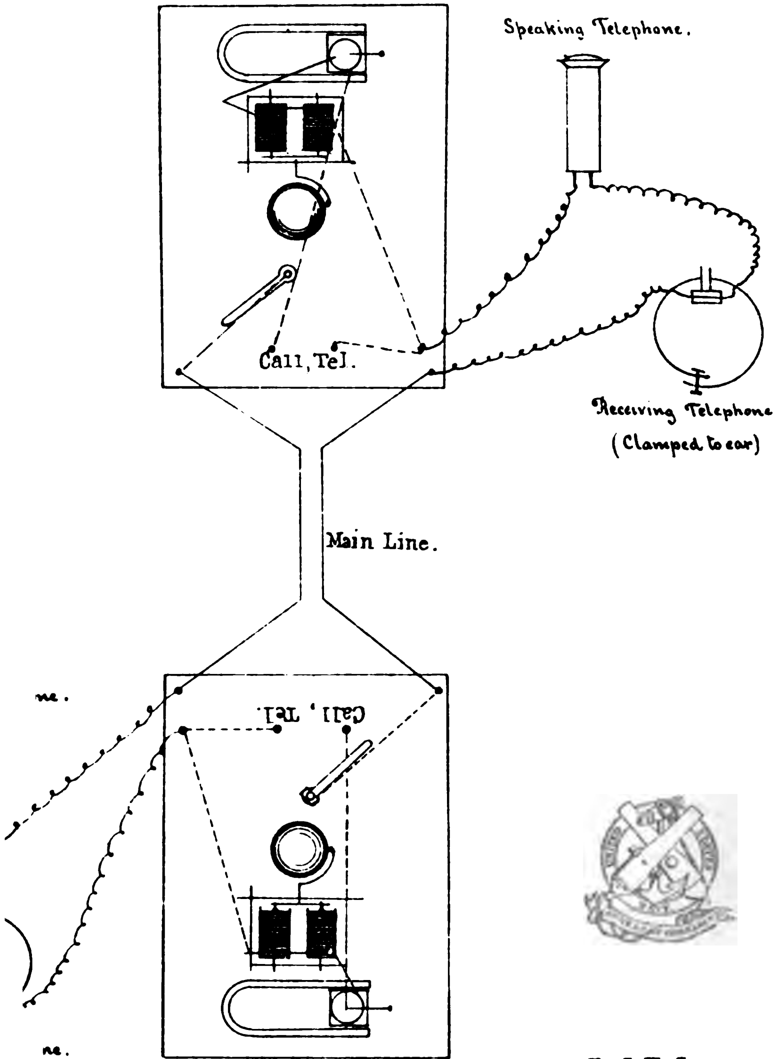
1464

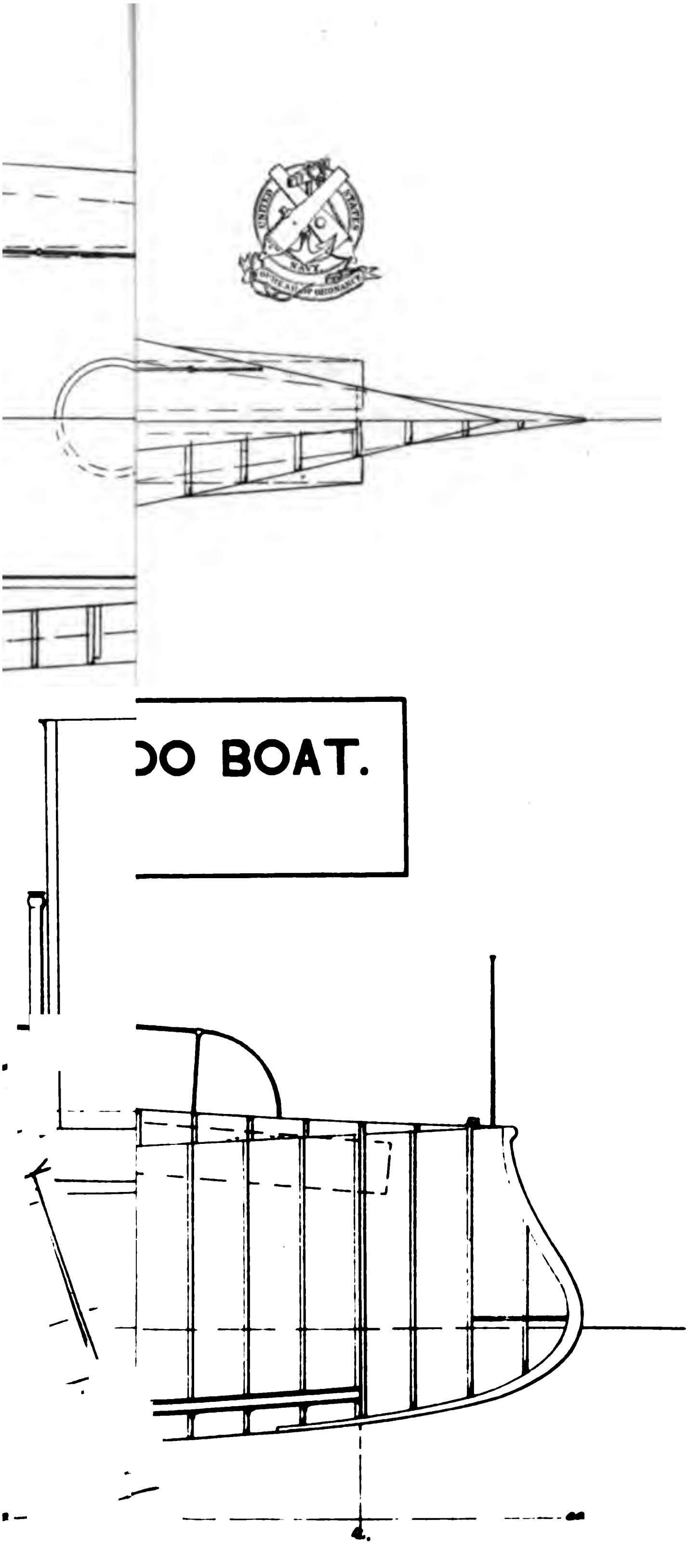


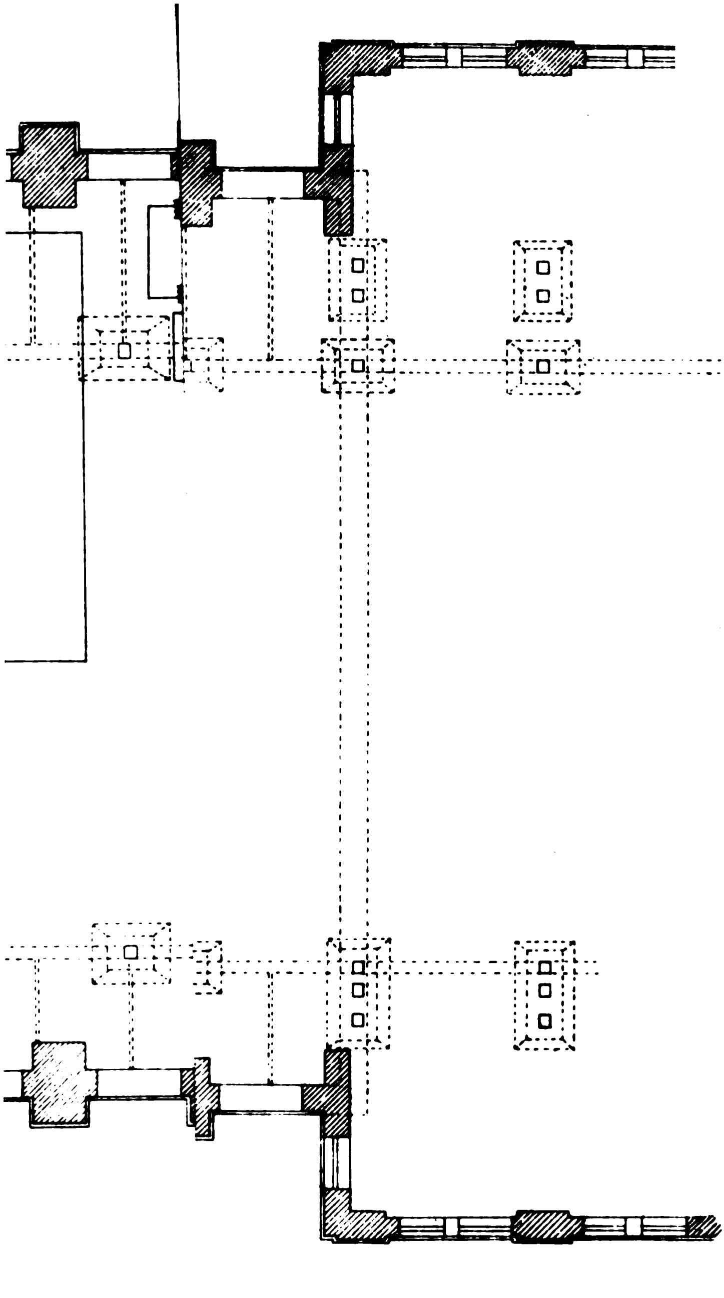
none.

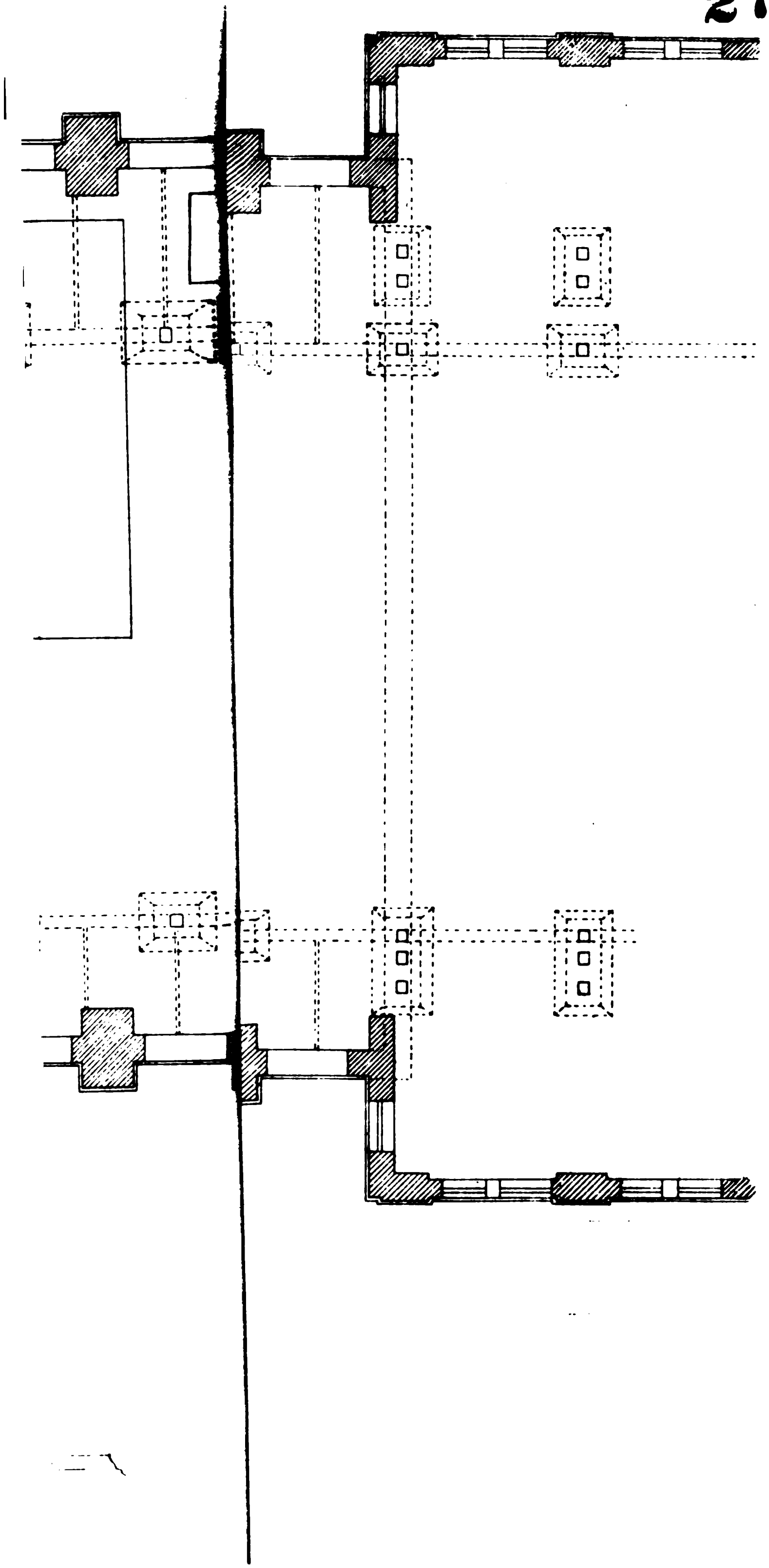
Navy50 2

1454


Speaking Telephone.
Call, Tel.
Receiving Telephone
(Clamped to ear)
Main Line.
Call, Tel.


DO BOAT.



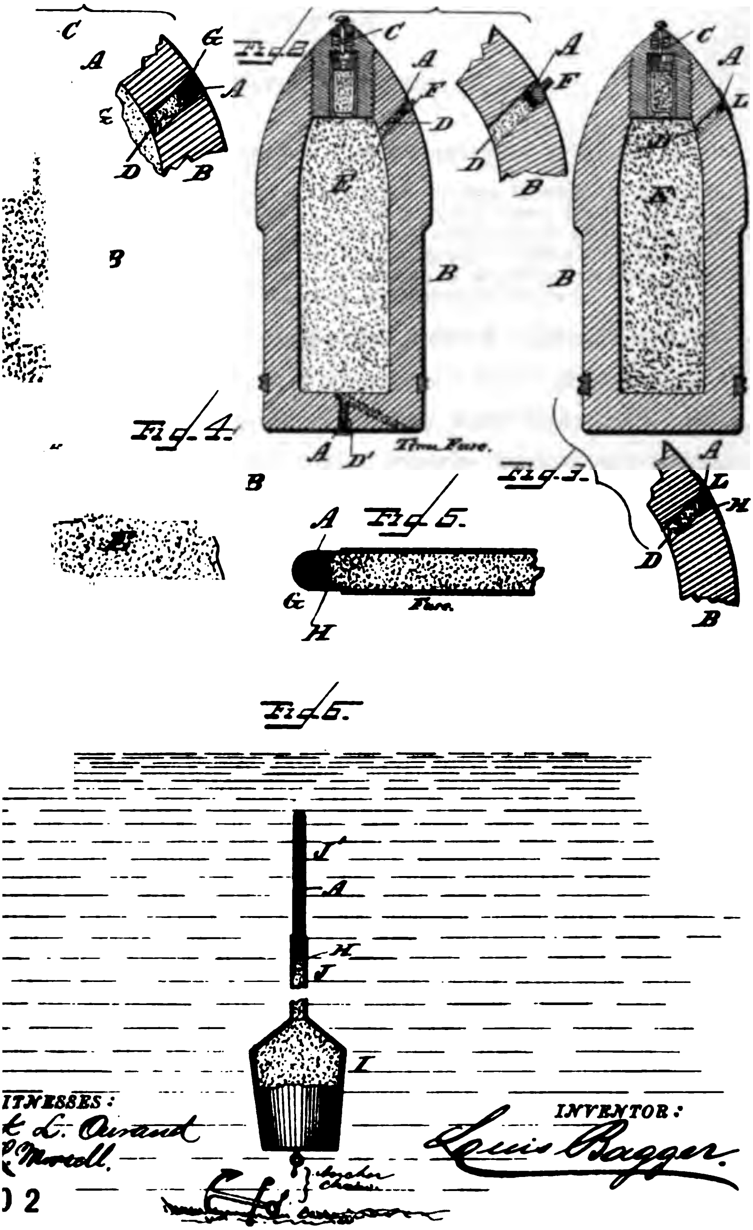


del.)

L. BAGGER.

PRIMER FOR IGNITING EXPLOSIVES.

359,491. Patented Mar. 15, 1887.



ITNESSES:

INVENTOR:

Louis Bagger.

) 2

APPENDIX.

TORPEDO STATION, NEWPORT, R. I.

OCTOBER 27, 1888.

: I have the honor to submit the following account of the work done at this during the past twelve months:

— the date of the last annual report the station has lost, through detachment, uable services of Lieut. J. B. Murdock. Mr. Murdock's term of duty here was by a great development of the applications of electricity to naval purposes. s to his coming the station was of little or no moment in the electrical world; ow widely recognized as an important laboratory of practical research. I can e-k too highly of his happy combination of theory and practice.

cers at present are:

ouant Commander G. A. Converse, principal assistant inspector of ordnance, tor in high-speed engines.

. W. I. Moore, assistant inspector of ordnance, just arrived and preparing to – Lieutenant Rohrer.

. Karl Rohrer, assistant inspector of ordnance, superintendent of the gun-factory.

. G. F. W. Holman, assistant inspector of ordnance, instructor in torpedoes.

. Hamilton Hutchins, assistant inspector of ordnance, instructor in electricity.

. C. McR. Winslow, assistant inspector of ordnance, assistant to torpedo officer.

n J. A. Dougherty, assistant inspector of ordnance, assistant to electrician.

on John C. Wise.

Assistant Paymaster F. H. Clark.

Charles E. Munroe [S. B. Harv.], chemist to Torpedo Corps, instructor in 'es.

: A. A. Phelps.

BUILDINGS AND PLANT.

principal wharf at the station has been reconstructed and the crane repaired. tension of the electrical laboratory was completed last fall. This important ng is now large enough to permit of lectures at one end and practical exercises other, simultaneously. A well planned and equipped room in the basement ates photometric work and the comparison and standardizing of various forms w and arc lamps. The tower of the laboratory has been most convenient for cting officers and men in the use of the search-light in all weather.

island is now well lighted at night. Besides the glow and arc lamps, men- last year's report, a 400-candle-power incandescent lamp has been mounted stable which will afford valuable protection to public property.

ation has been connected with the Newport water-works by a 3-inch main ig across the northern entrance to the harbor.

h work has been done on the sea-wall, under special appropriation; but the tude of the undertaking was not fully realized at the outset, or a larger sum have been asked. The work as done will leave nothing to be desired from the point of utility, being strong though rough. It is very doubtful whether the ete repairs can be effected in a proper manner for the sum appropriated. The ate of last year was closely made, but the money requested was not granted.

GUN-COTTON.

ew set of dies has been made, so that each block of gun-cotton is stamped with ate of its manufacture and the number of the "run" or charge. By this device lock may be traced back to the particular materials used, and even to the gen- tmospheric conditions prevailing at the time of its making; a valuable aid to ing stability tests ranging over a long period of time.

more expensive waste on hand up to the present moment is now exhausted trial is making of cheaper material, which is believed to be equally good.

The difficulty of transporting this safest of all explosives still continue without justification. In war time it would be suicidal to tolerate such re striction for a single day. Were wet gun-cotton in the least dangerous, tl not be said.

The recommendation of a year ago is renewed, that steps be taken to se manufacture of gun-cotton by private firms on the Pacific slope, and in the point somewhat removed from the coast.

There is no risk in using gun-cotton in shells from powder guns. This fac needed demonstration, still it was necessary to convince ourselves indepen the experience of others. As in so many other questions of practical gunner base fuze is sorely needed.

Another year's experience and many experiments confirm us in our opinio high and lasting qualities of this service explosive as expressed in my annu for 1887.

OUTFITS FOR SHIPS.

The current demands for torpedo outfits have been promptly met. The out remains unchanged. Of the progress of the defense mine the Bureau has b aware from time to time. There is but one detail in this equipment which satisfactorily passed the ordeal of repeated experiment. When this gap is brid supply of defense mines to the service can begin at once. The experime this mine have covered a long period, but time here is so much taken up struction that research always suffers.

The service diving lamp is now an article of issue. It has a constant cand of 150. Its voltage is variable, depending on that of the ship's incandesce

The Department is to be congratulated upon having effected business arran with a leading American firm by which it can secure complete and efficient tions of search-light apparatus, including engines, dynamos, and projectors of manufacture. To this result the station has largely contributed.

Dependent on the Bureau's formal approval, is a proposed boat and field t kit, lately submitted by this station. With this kit communication can l tained between two ships at anchor, or between a ship and her battalion on between the base and the front of military operations.

The scheme is very simple and the apparatus light and efficient. For assis prosecuting this research the station is under deep obligations to the Ameri Telephone Company.

The electric motor for training one of the *Chicago's* 8-inch B. L. Rs. is i vanced state. The electric motor has a wide area of usefulness on board sh ing, as it does, peculiar advantages under almost every head. It is light, nearly noiseless, always ready for work, reasonably efficient, and it does not surrounding air, while the conductors can be quickly repaired if cut by valuable feature in time of action. It will certainly, if slowly, replace ma auxiliary steam-engines now distributed about our ships, beginning with but occasional use.

The launch dynamo is still on paper. It was thought that the Parso electric generator might fulfill the conditions, being exceptionally light pact. The one with which we experimented was found to be wasteful of s rather noisy. The latter disadvantage, if too great, might be fatal in a tor or in a launch employed in countermining. A satisfactory engine and dy be developed by next spring ready for issue as a service article.

All of these electrical problems hung fire for many months, awaiting the of a standard voltage by the Department. Provisionally the recommendat late dynamo board, that all the dynamos have a constant potential of eight the terminals of the machine, has been followed by the Bureaus interested i ter, without the formal approval of the Department. It is hoped that, eve directed by the Department, this practice may continue until it will be imp electric lighting companies to burden the Navy with as many different v happen to suit their commercial convenience.

ELECTRICAL LABORATORY.

The increased facilities afforded by the new extension and by the addit eral important instruments have fitted the electrical laboratory at the s experimental work and testing on any reasonable scale. All dynamos a for the service should be sent here for trial before being accepted by the De

A No. 2 Edison shunt dynamo has been mounted in the dynamo room. useful in laboratory and photometer work, in lighting machine-shop on d etc. It is a very good dynamo of its type and size.

Messrs. Armington & Sims are building an engine for us which will p power over a considerable range at the disposal of the electrician.

storage battery is emerging from the tribulations incident to the early stages invention It may be useful on board ship in a number of ways, as, for instance, applying a limited number of day lamps; in furnishing a current for torpedo ulsion; for firing guns; for signaling; possibly in launches, etc. Locally, a age battery will be of importance in yielding a steady current for delicate photo-ric work. Altogether, it would seem as if an investigation into the merits and racteristics of the principal forms of secondary cell would benefit the naval ce.

CHEMICAL LABORATORY.

The activity of this branch of the station may be best grasped by glancing at the of completed researches given later, wherein a large number are seen to have been chemical nature. It is in this record that the chemical laboratory would find its fication, were any needed. The faithful labors and technical skill of Professor roe have been of great value to the Bureau, both in the lines of analysis and of rch.

xpect to be able to improve the chemist's facilities during the fiscal year, by ju-ns re-arranging of the laboratory space so that special work may go on without uption, the apparatus for certain standard analyses being permanently and con-ntly mounted.

ne of the most important functions which this station should perform is the study ne properties of all explosive substances known in the market, or such as can be ufactured here from the raw materials. This should be done, not because we expect to obtain a better explosive for general service use than gun-cotton (for that bability is somewhat remote), but that the real value of these explosives may be rmined and demonstrated before the officers of our Navy. In these days of fre-t announcement of new explosives, for which extraordinary power and proper-are claimed, it may happen that, in action, the statement that the enemy pos-s these extraordinary explosives may have such a moral effect as to paralyze the king force or to deter it from making an assault. This would not occur if the characters of the substances were known.

We have been much hampered in our endeavors to carry on this work, owing to the ulty of securing transportation here for material coming from New York, but seems to be no difficulty in obtaining supplies from the various manufacturers delivered in that port.

ny experiments on the method proposed for testing the integrity of metals and resistance to shock by means of detonating explosives have been made with imens of iron, steel, and aluminum bronze of known chemical composition and sical properties, which have been supplied by the United States Iron and Steel ting Board, the United States naval inspectors of steel, and the Cowles Electric elting and Aluminum Company. Although, from the nature of things, no precise clusions can be drawn until a very large number of experiments have been made, the results already obtained show that the method is a very promising one and ely to be of extreme value.

n the course of experiments to determine the amount of moisture gun-cotton might tain and yet be detonated, Professor Munroe observed some wonderful and inter-ng wave-like effects produced by the explosion. With the Bureau's permission, s was given to the public through the American Journal of Science. A copy of fessor Munroe's memorandum is inclosed. The phenomena are full of suggestions the student of molecular physics, although but a by-product, so to speak, in our ular work.

During the past year, analyses of steel for our new guns, gun-carriages, etc., have n made by order of the Bureau. That this work is of the first importance is shown the fact that the Bethlehem Iron Company have erected one of the largest chem-l laboratories in this country, employing some two score or more of analysts in ex-ining their product.

. special room in the laboratory for the analysis of iron and steel is to be perma-tly fitted with the appliances necessary for this purpose. In order, however, that ile this important work is being carried on none of the other interests of the sta-n which demand the attention of the chemist be neglected, I recommend that the artment or the Bureau employ an analyist of metals to do the work needed for the ry here, where facilities already exist.

TRIANA AND BOATS.

The *Triana* is in good condition. All the boats have been well cared for. Probably no time in the history of the station have the boats been, on the whole, so efficient. *Stiletto* has been of great value as a means of instruction during the summer. re is but one known method of teaching officers and men how to run and maneuver

torpedo boats, and that is by actual practice. The *Stiletto* has been under
deal—in smooth water and rough—by night as well as by day. The experi
valuable. If an automobile torpedo and launching tube were mounted or
she would be as efficient for all the purpose of experiment and instructio
were a first-class sea-going torpedo boat.

The pontoon built under special appropriation last year is of great use to tl
When the old landing stage at the island is replaced by the new one, just a
and the ferry wharf at the station rebuilt, the terminal facilities will be bey

INSTRUCTION.

The advanced course of instruction begun by Lieuts. J. M. Bowyer, Cam
Winslow, Richard Henderson, and Ensign J. A. Dougherty was complet
second and the last named. As in the previous years, these gentlemen wer
members of the Experiment Board. The gain to them and to the station ju
continuance of this policy.

The summer course was pursued by the following officers:

In attendance.—Commanders George W. Sumner, William S. Dana, Thom

Under instruction.—Lieut. Commanders Robert E. Impey, Fred. W. Crock
tenants Charles Belknap, Seaton Schroeder, Nathan E. Niles, Nelson T.
Clayton S. Richman, Corwin P. Rees, William C. Babcock, William R. A
Ensigns Harry M. Dombaugh, Albert P. Niblack, Francis R. Wall; Capt
M. C.) Harry A. Bartlett, Second Lieutenant (U. S. M. C.) George Barnett
Elisha J. Beacham.

Lieut. Commander Robert E. Impey was detached at the end of the first

Assignment of time.

MAY.

Day of month.	Nature of instruction.	Department.	Nature of instruction.
	A. M.		P. M.
1	Class reports.		
2	Lecture—Introduction, currents, Ohm's law.	Electricity..	....
	....	Chemistry ..	Lecture—General review of cl
3	Lecture—Magnetic effect of currents..	Electricity..	....
	....	Chemistry ..	Lecture—General review of cl
4	Lecture—Batteries..................	Electricity..	....
	....	Chemistry ..	Lecture—Combustion and ex
7	Lecture—Farmer's A and C machines.	Electricity..	....
	....	Chemistry..	Lecture—Explosives of gu class.
8	Lecture—Spar torpedo outfit..........	Torpedoes ..	Practical—Testing and splici
9	A. Practical—Farmer's A and C machines.	Electricity..	B. Practical—Farmer's A machines.
	B. Practical—Gunpowder igniters	Fuzes	A. Practical—Gunpowder ign
10	Lecture—Preparation of spar torpedo for service.	Torpedoes ..	B. Practical—Preparation of pedoes for service.
	....	Electricity..	A. Practical—Batteries......
11	B. Practical—Batteries..............	Electricity..	....
	A. Practical—Preparation of spar torpedo for service.	Torpedoes ..	Lecture—Ship's and boat's ou
14	Lecture—Magnetism	Electricity..	....
	....	Fuzes	A. Practical—Gunpowder fu
	....	Torpedoes ..	B. Practical—Use of firing a
15	Lecture—Dynamos	Electricity..	....
	....	Fuzes	B. Practical—Gunpowder fu
	....	Torpedoes ..	A. Practical—Use of firing a
16	Lecture—Dynamos	Electricity..	B. Practical—Dynamos.....
	....	Fuzes.......	A. Practical—Gunpowder fu
17	Lecture—Dynamos	Electricity..	A. Practical—Dynamos .....
	....	Fuzes.......	B. Practical—Fuzes........
18	Lecture—Explosives of Chlorate class	Chemistry ..	Practical — Explosives of class.
21	Lecture—Nitro-ethers—Nitro-glycerine and dynamite.	Chemistry ..	Practical — Nitro-ethers—Ni erine and dynamite.
22	Lecture—Nitro-ethers—Gun-cotton...	Chemistry ..	Practical —Nitro-ethers— ton.
23	Lecture—Nitro-ethers—Gun-cotton..	Chemistry ..	Practical — Nitro-ethers— ton.
24	A. Practical—Manufacture of gun-cotton.	Chemistry ..	B. Practical—Manufacture cotton.
	B. Practical—Armington and Sims engine.	H. S. Eng's.	A. Practical—Armington a engine.

Assignment of time—Continued.

MAY—Continued.

Nature of instruction.	Department.	Nature of instruction.	Day of course.
A. M.		P. M.	
Lecture—Boat fittings and contact torpedo.	Torpedoes..	Lecture—Accidents—Precautions to be observed.	18
Lecture—Explosives of the Fulminate class.	Chemistry..	Practical*—Explosives of the Fulminate class.	19
A. Practical—Preparation of contact torpedo.	Torpedoes..	B. Practical—Preparation of contact torpedo.	20
B. Practical—Launches' engines......	H. S. Eng's..	A. Practical—Launches' engines.....	
A. Practical—Dynamos..............	Electricity..	B. Practical—Dynamos..........	21
B. Launches' engines..................	H. S. Eng's..	A. Practical—Launches' engines.....	

JUNE.

Lecture—Explosives in general.......	Chemistry..	Lecture—Use of high explosives in shell.	22
Lecture—General theories of explosives.	Chemistry..	A. Practical—Dynamos..............	23
....	Electricity..	B. Practical—Testing dynamos.......	
Examination—Explosives........	Chemistry..	Examination—Explosives............	24
B. Practical—Firing exercise torpedoes from boats.	Torpedoes..	B. Practical—Firing service torpedoes from boats.	25
A. Practical—Testing dynamos.......	Electricity..	....	
....	H. S. Eng's.	A. Practical—Herreschoff engines....	
A. Practical—Firing exercise torpedoes from boats.	Torpedoes..	A. Practical—Firing service torpedoes from boats.	26
B. Practical—Preliminary instruction in diving.	Diving......	....	
....	H. S. Eng's..	B. Practical—Herreschoff engines.....	
Lecture—Torpedo instructions.......	Torpedoes..	Lecture—Firing apparatus...........	27
B. Practical—Use of firing apparatus	Torpedoes..	A. Practical—Use of firing apparatus.	28
A. Practical—Preliminary instruction in diving.	Diving.....	B. Practical—Diving in shoal water..	
Lecture—Units.......................	Electricity..	....	29
....	Torpedoes..	A. Practical—Making and firing improvised torpedoes.	
....	H. S. Eng's.	B. Practical—Westinghouse engines..	
Lecture—Search-lights..........	Electricity..	....	30
....	Torpedoes..	B. Practical—Making and firing improvised torpedoes.	
....	H. S. Eng's..	A. Practical—Westinghouse engines.	
A. Practical—Firing exercise torpedoes from tug.	Torpedoes..	A. Practical—Firing service torpedoes from tug.	31
B. Practical—Brotherhood engines....	H. S. Eng's..	B. Practical—Brotherhood engines..	
B. Practical—Firing exercise torpedoes from tug.	Torpedoes..	B. Practical—Firing service torpedoes from tug.	32
A. Practical—Brotherhood engines....	H. S. Eng's.	A. Practical—Brotherhood engines....	
Lecture—Incandescent lights.........	Electricity..	B. Practical—Incandescent lights.....	33
....	Diving......	A. Practical—Diving in shoal water..	
Lecture—Defense against torpedoes..	Torpedoes..	Lecture—Defense against torpedoes..	34
Lecture—Electrical measurements...	Electricity..	A. Practical—Incandescent lights.....	35
....	Diving......	B. Practical—Diving in shoal water...	
Lecture—Electrical measurements....	Electricity..	B. Practical—Measurement of currents.	36
....	Diving......	A. Practical—Diving in shoal water..	
Lecture—Characteristics of defensive mines.	Torpedoes..	Lecture—Characteristics of defensive mines.	37
Lecture—Characteristics of defensive mines.	Torpedoes..	Lecture—Characteristics of defensive mines.	38
Practical—Laying out defensive mines	Torpedoes..	Practical—Laying out defensive mines.	39
Practical—Laying out defensive mines.	Torpedoes..	Practical—Laying out defensive mines.	40
Practical—Laying out defensive mines.	Torpedoes..	Practical—Laying out defensive mines.	41
Practical—Laying out defensive mines.	Torpedoes..	Practical—Laying out defensive mines.	42

Assignment of time—Continued.

JULY.

Day of month.	Nature of instruction.	Department.	Nature of instruction.	Day of course.
	A. M.		P. M.	
2	Lecture—Electro-magnetic induction	Electricity	A. Practical—Measurement of currents.	43
	....	Diving	B. Practical—Diving in shoal water	
3	Lecture—Telephone, telegraph, etc	Electricity	B. Practical—Measurement of E. M. F.	44
	....	Diving	A. Practical—Diving in shoal water	
5	Lecture—Electro-chemistry	Electricity	A. Practical—Measurement of E. M. F.	45
	....	Diving	B. Practical—Diving in deep water	
6	Lecture—Removal of obstructions	Torpedoes	Lecture—Removal of obstructions	46
9	Practical—Removal of obstructions	Torpedoes	Practical—Removal of obstructions	47
10	Lecture—Clearing passages through submarine mines.	Torpedoes	Lecture—Clearing passages through submarine mines.	48
11	Practical—Clearing passages through submarine mines.	Torpedoes	Practical—Clearing passages through submarine mines.	49
12	Lecture—Electric motors	Electricity	B. Practical—Measurement of resistance.	50
	....	Diving	A. Practical—Diving in deep water	
13	Lecture—Automobile and controlled torpedoes.	Torpedoes	Lecture—Automobile and controlled torpedoes.	51
16	Lecture—Automobile and controlled torpedoes.	Torpedoes	Lecture—Automobile and controlled torpedoes.	52
17	Lecture—Alternate current dynamos.	Electricity	A. Practical—Measurement of resistance.	53
	....	Diving	B. Practical—Diving in deep water	
18	Lecture—Torpedo boats	Torpedoes	Lecture—Torpedo boats	54
19	Lecture—Torpedo boats	Torpedoes	Lecture—Torpedo boats	55
20	A. Practical—Second-class torpedo boats (*Stiletto*). B. Practical—General exercises	Torpedoes	B. Practical—Second-class torpedo boats (*Stiletto*) A. Practical—General exercises	56
23	Lecture—Submarine boats	Torpedoes	Lecture—Submarine boats	57
24	Lecture—Pneumatic dynamite gun	Torpedoes	Lecture—Firing high explosives from naval ordnance.	58
25	A. Practical—Diving in deep water	Diving	Practical—Diving in deep water	59
	B. Practical—Dynamos	Electricity	....	
26	Examination	Torpedoes	Examination	60
27	Examination	Electricity	Examination	61
30, 31	Practical exercises before the Board of Visitors.	....	Practical exercises before the Board of Visitors.	62, 63

The course of instruction has been enlarged, the number of lecture topics increased, and as thorough an exposition of each topic given as the limited term of attendance allowed. Practical exercises with the material the service possesses have been given prominence in the course, but complete satisfaction can not be had in this respect until we possess automobile and controlled torpedoes, and at least one torpedo-boat fitted for practice with the former.

A comparison of this course with its predecessor will bring out the differences which are both of degree and of kind.

The themes presented in solution of certain tactical problems were all suggestive, and some were valuable additions to the literature of the profession. The Board of Visitors thought so well of the essays by Lieutenants Niles and Rees (Question No. 3) and of Lieutenants Belknap and Schroeder (Question No. 6), as to advise their publication in the proceedings of the Naval Institute.

TACTICAL PROBLEMS.

(1) Prepare a mine and torpedo defense of New York and its approaches, making use of the best modern material. Give the general features and the distribution.

(2) Discuss the value and use of the search-light in naval blockades.

(3) An iron-clad is compelled to anchor in Newport Harbor pending repairs to her engines. Prepare a defense against torpedo attack, using but her own resources.

(4) Prepare tactics for a group of six torpedo-boats: (*a*) For ordinary cruising; (*b*) when cruising in search of an enemy; (*c*) for attack on a single ship under way; (*d*) for attack on an opposing group of torpedo-boats.

(5) Discuss the best means for identifying the torpedo-boats of a group. Discuss the signals best fitted for use in such a group: (*a*) In ordinary day cruising; (*b*) in fog or darkness; (*c*) in presence of an enemy by day and night; (*d*) in attack.

(6) Discuss the defense of the *Chicago*, when at anchor, against an attack by the bmarine boat *Nordenfeldt*.

(7) Discuss the value of the *Vesuvius*: (*a*) As a part of a fleet attacking a position fended by guns and mines; (*b*) in a general fleet engagement; (*c*) in defense of a rbor like that of New York.

The last class showed less interest than usual in the practice of diving. Eight re unwilling to go down in the suit.

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The work consists of dynamo-room watch, and during the watch practical work ll be had with different dynamos, search-lights, automatic arc lamps, and incandescent lights.

The watch will commence ten minutes before sunset and end at 9.45 p.m.

Two dark nights will be selected for search-light work with the *Triana*.

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Detail for June and July, 1888.

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25	Fourth.	15	Fourth.
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6	Third.	26	Third.
7	Fourth.	27	Fourth.

The station and the naval service were highly honored by the presence of certain l known authorities on electrical matters who came to Newport and lectured on ir respective specialties before the class.

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ncandescent Lamps, by John Howell, of the Edison Lamp Company, July 17, at a. m.

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Prof. Alex. Graham Bell would have favored us with a talk on the telephone had not been called to England to testify before the royal commission on the instruc- n of the deaf and dumb.

The importance and value of these most interesting *conversazioni* were only equaled the courtesy of the gentlemen who consented, at much personal inconvenience, to the Bureau in making the course as useful and complete as the time at its dispo- on allows.

At the conclusion of the instruction the class were examined on the following ques- ns:

Assignment of time—Continued.

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Day of month.	Nature of instruction.	Department.	Nature of instruction.
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	....	Diving	A. Practical—Diving in shoal water.
5	Lecture—Electro-chemistry	Electricity	A. Practical—Measurement of E. M. I
	....	Diving	B. Practical—Diving in deep water.
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25	A. Practical—Diving in deep water	Diving	Practical—Diving in deep water....
	B. Practical—Dynamos	Electricity	....
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At the conclusion of the instruction the class were examined on the following quesns:

Chemistry.

(1) What is bellite and how is it made? What advantages are claimed for it?

(2) Describe the process of making fulminate of mercury and of filling service de onators as carried on at the Torpedo Station. What precautions must be take the manufacture and use of detonators to insure success in use? What position the detonator hold in any explosive system, such as a torpedo or mine?

(3) What advantages does gun-cotton possess as a naval explosive? To wha the feeling of insecurity regarding the stability of gun-cotton, which has existed i past, been due? What methods are pursued for testing military gun-cotton in to determine if it is in suitable condition, for issue to the service or for storage on s board?

(4) Describe the process of manufacture of service gun-cotton as conducted at th Torpedo Station. In what form, condition, and containers is it issued to the servic

(5) What advantages would accrue if our present service guns could be safely u under service conditions to project shell filled with high explosives? What are th prospects of this result being attained? Cite some experiments which have been looking to this result. What is the chief obstacle to success? What are the tions which determine the efficiency of such shell when used against armor?

(6) What are the Sprengel mixtures? Cite two examples of such, giving com tion and mode of use. Has either of them been successfully used in practice?

(7) What is dynamite? How is it made, used, tested, and handled, especially frozen? How is it exploded in the arts?

(8) What is explosive gelatine, and how is it made? For what purpose is it p posed to use it in war? What advantages and disadvantages does it possess for th purpose?

(9) Show the relation of combustion to explosion and detonation. How is the gr explosiveness of nitrogen chloride explained? What light has the study of the e plosive amides and amines thrown upon the properties of the explosive compounds i general?

(10) What is cocoa powder? Point out how the advantages of a high ini locity with a low pressure are secured. What is the probable source of the c used in the German cocoa?

Electricity.

(1) What are the requisites of voltaic cells for torpedo work on board ship, and which cell are these conditions most nearly realized?

(2) What is the fundamental principle of a dynamo? What causes sparking at th brushes, and what means should be taken to prevent it, both in construction and handling? State briefly the advantages and disadvantages of series, shunt, and co pound dynamos for ships' use.

(3) What are ordinarily the weak points of an incandescent light installation what precautions are necessary in this respect on board ship?

(4) What must be the relation of the polarity of the armature to that of the fi in order to reverse a motor?

(5) How do you start a shunt motor?

(6) How would you improvise a firing-battery on board ship?

(7) Calculate the gross and commercial efficiencies of a compound dynamo shunt) from the following data:

H. P. applied		25
Difference of potentials at terminals	volts..	100
Current in external circuit	ampere..	14[illegible]
Resistance of armature	ohm...	
Resistance of series field coils	do ...	
Resistance of shunt field coils	ohms..	5.[illegible]

(8) The specific resistance of pure copper being 1640, what is the resistance a F. of 500 feet of wire 4 millimeters in diameter, having a conductivity of 98 per ce pure copper?

Torpedoes.

(1) Describe in detail and show the arrangement of the permanent fittings suppl to ships.

(2) Describe the boat-fittings supplied to the service and explain how they are us

(3) Prepare a service torpedo and explain the method of firing it from a ship a from a boat, giving each step in detail.

(4) Prepare an exercise torpedo, giving each step in detail.

(5) Prepare a contact torpedo and explain the method of firing it on contact and will, giving each step in detail and tracing the path of the currents.

(5) Trace the circuits, in testing and firing, from a firing battery to and from a pedo, using the firing-plate; also, from an A machine to the torpedo and back, the firing-key.

. What are the different classes of submarine mines, and under what circumes is each class properly employed?

Explain the different methods of clearing passages through submarine mines assive obstructions.

term concluded by a number of practical exercises before the Board of Visitors.

PRACTICAL EXERCISES BEFORE BOARD OF VISITORS.

Explosives.

(1) Conduct the Board through the gun-cotton factory and explain the various es employed in making gun-cotton.

With the apparatus before you, explain the process employed at this station making nitrc-glycerine.

(3) With the apparatus before you, explain the method of applying the "heat " for the stability of gun-cotton.

(4) With the apparatus before you, describe the method of making the solubility for gun-cotton.

(5) Demonstrate the way in which the "monthly test" for dry gun-cotton primers be made, using several jars of primers.

Explain how fulminate of mercury is made and service detonators are filled.

, Show, by exploding in an empty exercise torpedo case, a block of wood and a of water, the power of a service detonator.

Detonate a disk of dry gun-cotton freely exposed on an iron plate. Repeat the ment, using one disk of wet and one of dry gun-cotton.

Using 6 half-inch disks of dry gun-cotton, show what is meant by the term losion by influence."

(10) Place a box of wet gun-cotton in a bonfire, and, after it is partially consumed, ve some of the unconsumed disks and detonate them on an iron plate by means of y primer. Set fire to a dry disk and extinguish it by means of water.

(11) Cut a plank by means of a superficial charge of gun-cotton.

(12) Detonate a dynamite cartridge by means of a Bickford fuse and blasting cap, ing previously determined the rate at which the fuse burns.

Fuses.

(1) Explain in detail the manufacture and action of the service detonator.
(2) Explain in detail the manufacture of the service ignitor.
(3) State what faults are apt to occur in detonators.

Electricity.

(1) Wire up, test, and operate a circuit of six incandescent lights.
(2) Describe the installation of incandescent lights at the torpedo station.
(3) Given two push buttons, two electric bells, a battery, and wire. Connect them that each button will ring the bell at either end of the line, using the least wire ble.
(4) Given the same as the preceding. Connect them so that each button will ring h bells.
(5) Operate a Serrin automatic lamp from a Gramme dynamo.
(6) Operate two Brush automatic lamps in series from a Brush dynamo.
(7) Operate a service search-light apparatus consisting of hand-lamps, Mangin proor, Brotherhood engine, and Gramme dynamo.

High-speed engines.

(1) Describe the Westinghouse high-speed engine.
(2) Describe the Armington & Sims high-speed engine.
(3) Describe the Brotherhood high-speed engine.
(4) Describe the Herreshoff high-speed engines and boilers on the *Spray*, *Success*, *Stiletto.*

Torpedoes.

(1) Prepare and fire exercise torpedoes from boat (two officers).
(2) Prepare and fire a service torpedo from boat (one officer).

(3) Prepare and fire an improvised gunpowder mine (one officer).
(4) Prepare and fire observation mines, using plane table (six officers).
(5) Destroy a boom (two officers).
(6) Rig countermining launch and fire countermines (six officers).

Diving.

(1) Go down in a diving suit.
(2) Attend the diver.

It is with regret that I have to refer to an episode that reflects but little cred the Navy.

Lieut. N. T. Houston and Ensign F. R. Wall were reported by their classmate having obtained possession of the questions in torpedoes and electricity prior to examination. The Navy Department has taken prompt and strong measures in premises.

In future I recommend that the procedure of this year be adhered to, and the ordered to report on May 1.

EXPERIMENTS.

The experiment board continues its career of usefulness.

It has returned replies, based on experiment, to the following questions:

(*a*) Determine the influence of the relative position of gun-cotton charge and t by exploding the charge in contact with the target, and at very small distances fr

(*b*) What is the minimum of dry gun-cotton necessary to detonate a quanti wet gun-cotton, using the regular detonator?

(*c*) Determine the largest percentage of water which gun-cotton may contai yet be detonated with certainty.

(*d*) To determine whether gun-cotton and other high explosives can be det by gunpowder when strongly confined.

(*e*) Determine the condition under which hollow projectiles, charged with cotton or other high explosives, may be fired from great guns with safety, and the maximum degree of efficiency may be realized for them.

(*f*) Determine the destructive effect of gun-cotton on guns.

(*g*) Determine whether or not incandescent electric lights may, under some cir stances, be dangerous for ship lighting.

(*h*) Determine how long an exposure of an imperfectly closed exercise torp necessary to drown the dry primer charge of gun-cotton.

(*i*) The use of telephones between ships, boats, and landing parties.

(*j*) May saltpeter, nitric acid, and chlorate of potash be detonated separate means of fulminate of mercury?

The board has also made reports on various technical matters referred to it time to time, such as Apel's chemical packing paper, the efficiency of the T electric generator, the electrical firing of great guns, etc., and other confid topics.

The experiments with gun-cotton and proposed explosives of high order for powder guns have been reported to the Bureau from time to time. It is not ad ble to say more now than that the subject is under constant investigation and trials of something which promises exceedingly well are about to begin.

MISCELLANEOUS.

Last spring the Old Colony Steamboat Company, proposing to substitute an el light for the oil lamp with which they have heretofore illuminated the beacon edge of the channel south of Goat Island, obtained permission to lay wires island, and connect their beacon with the distributing point of our electric li system. The work was done under my supervision and inspection. The new (though of but 32 candle power) is quite brilliant and an unmistakable harbo It was started on the 25th of May, and it has given great satisfaction to the ping community.

The cost of running the light, it is hardly necessary to explain, is borne b steamer company.

It may be well to record the fact that the first steps have been taken to est a systematic training in marksmanship here that men certificated as seamen gu may be in fact what their title implies.

I beg to renew my recommendations as to a volunteer torpedo corps. Se excellent men were prepared to join last summer's course had the Department its way clear to granting permission. This portion of a naval reserve scheme c put into execution at once, and the sooner the better.

The time-ball service is irregular. The noon beat is not received half the t

The renewal of the underground wires and apparatus for signals, fire al has begun.

PUBLICATIONS.

The station press has been of great use, enabling instruction to proceed without elay. It has brought out a new edition of the Torpedo Instructions, Catechisms of xplosives, and the Spar Torpedo, several of the lectures delivered here, specificaions for the Bureau, etc. Its work is good and it serves to turn out seamen printers.

CONTINUOUS SERVICE MEN.

My remarks of last year apply as well to-day to the instruction of the men sent ere for training as seaman gunners. They exhibit especial interest in diving and in ectrical work, and they leave here creditably proficient in all the branches taught. s a body, they are excellent in character, extremely well behaved, intelligent, and ealous.

LIBRARY AND RECORDS.

During the past year 232 books have been added to the library and 50 have been ind. The cards added to the book index amount to 319, while those added to the odical index number 2,725. The indexing of the periodical literature is divided assignment among all the officers on duty here, either as instructors or under ad- zed instruction. As these gentlemen read the magazines very closely, they are t, to that extent, *au courant* of the recent progress in science and art as applied to ir profession. Valuable as this recent information is, yet, in order to fulfill the st important function of the station, it is necessary to know the state of the art the development of the science up to the moment of commencing our work. This wledge can only be gained from the periodical literature of former years. Owing he lack of complete sets of professional and scientific journals, either in this library elsewhere within a practically accessible distance from Newport, we are continually ered in our work. I repeat my recommendation of last year that provision be e to secure back numbers of periodicals to complete our sets, and that a fixed sum annually granted for the maintenance of the library.

One consideration may be added to those offered above in support of this request. is well known that at any moment litigation is apt to arise or a claim made for ensation for the use of devices or machines in the Navy. It is more than proba- hat if we possessed such a library of technical and scientific books as is described ve, fully indexed and in expert hands, a sum of money might be saved the Gov- ent in a single case which would many times surpass the cost of the entire

RECOMMENDATIONS.

(1) The addition to the fleet of more torpedo-boats.
(2) The securing of a service automobile torpedo.
(3) The securing of a controlled torpedo for harbor defense.
(4) The continuation and expansion of the present interesting and valuable re- arches in the properties of explosive substances.
(5) The sea wall around the Island should eventually be rebuilt, on the south and st sides, as well as north and west where the work is in hand. This must be done some future day. It would be better to do it now, but I do not urge the measure h too much pertinacity.
(6) An analyst of metals for general service, investigations, and tests.
(7) The repetition of the extra lectures by specialists.
(8) Investigation of captive balloons from ship board for scout and patrol duty.
(9) The enlarging of the old torpedo boat-house, to receive the *Stiletto* and other torpedo-boats.
(10) The building of a marine railway capable of hauling up torpedo-boats of the first class.

An estimate of $10,000 has already been submitted for this improvement. So important do I deem this project and (9) that I have refrained from asking special grants of money for all other wants of the station, some of which are pressing.

The professional reputations of my assistants are too well established to require any praise on my part, but I must express my obligation to their ability, interest, and al, for many valuable suggestions, and a loyal support, which have greatly lightened labors. The near detachment of Lieutenant Karl Rohrer and Passed Assistant ymaster F. H. Clark will deprive the station of a singularly capable, well-poised rt in explosives and of a purchasing agent by whose forethought and care our ty appropriation has been made to do almost double duty.

Respectfully, your obedient servant,

C. F. GOODRICH,
Commander U. S. N., Inspector of Ordnance, in charge of Station.

CHIEF OF BUREAU OF ORDNANCE,
Navy Department, Washington, D. C.

NAVAL ORDNANCE PROVING GROUND, ANNAPOLIS, MD.

OCTOBER 29, 18

SIR: The following summary is respectfully submitted of the work done a Naval ordnance proving ground during the past year:

This work has included, with other matters of less importance, the proof of carriages, and secondary mounts, for the armament of the new crusiers: the de ment and test of powders for both old and new armaments, including Hotchkis of various calibers; ballistic tests of material for gun carriages, gun shield the trial of cast-steel common shells; the firing of high explosives from powder the ranging of guns and construction of range tables; the statutory test of inch B. L. R.; the test of the maxim automatic machine gun, and, for purpo comparison, of the Gatling gun; the trial of a gallery rifle for target practis shipboard; and of a drill cartridge for use with Hotchkiss guns.

PROOF OF GUNS.

Since the date of my last annual report (October 13, 1887) there have been pr two 5-inch B. L. R's, seven 6-inch B. L. R's, three 8-inch B. L. R's, one 10-inch B.

These tests have taken place absolutely without accident. Not only has ever passed its proof without an indication of weakness, but all of the fittings—the b mechanism, gas checks, and firing attachments—have, after being finally adju proved most satisfactory.

In addition to the proof rounds with service charges and pressures to whi guns are subjected, the above guns have in almost every instance fired rounds pressures much above those of service, in the course of experimental work with powders.

Of the guns above enumerated, one was for the battery of the *Boston*, eleve that of the *Chicago*, and one for the *Miantonomoh*. The *Boston* received the last guns in June.

One of the *Chicago's* guns, a 6-inch, has been shipped to New York, the othe at present here, but will be shipped within the next few weeks. Two of the yet to be proved.

An 8-inch central pivot carriage, also for the *Chicago*, has just been received, will be tested in about a fortnight.

Since the shipment of the *Boston's* 8-inch mount, and while awaiting that fo *Chicago*, all firing with this caliber has been done on a 15-inch monitor car which, in anticipation of a period when no service carriage would be available, been adapted for this work some time ago.

The first 10-inch B. L. R. (for the *Miantonomoh*) was received nearly a year but its mount was not completed until several months later.

The gun and mount, with all the hydraulic apparatus for working them, were early in May, and the gun was fired for the first time on the 14th of that m Everything worked very satisfactorily, but the powder, an experimental sa made by the Messrs. DuPont, proved too quick.

Ten rounds have since been fired from this gun. The gun has been amply pr and the mount has been found both strong and convenient. Unfortunately the der is not yet satisfactory.

The first of the Mark III 6-inch guns, intended for the *Yorktown*, has just bee ceived, together with a 6-inch central pivot carriage, belonging to the same These will be tested within a few weeks.

The 6-inch cast-steel gun from the Pittsburgh Steel Casting Company was rec on the 22d instant. It will be mounted and tested as soon as its carriage is pared.

On October 26, the "statutory test" of the 5-inch caliber took place, a gun of caliber (5-inch B. L. R. No. 2) being fired, for ten rounds as rapidly as the piece be served. The gun passed the test successfully.

POWDER.

At the date of my last report, the development of a domestic brown powder f 8-inch caliber had just been successfully completed and a sample tested which the Bureau's specifications, giving an initial velocity of 2,000 foot-seconds w pressure below 15 tons. This was the powder supplied to the *Boston*. It was en satisfactory, except in the low density of loading. The chamber of the 8-incl is designed for a charge of 125 pounds. The powder in question gave the sta velocity with 113 pounds, thus leaving a somewhat larger air space than is able.

It was therefore thought better to modify the manufacture in such a direction as should permit the use of a higher density of loading; and we have been working in this direction in various samples made and tested under orders for the *Chicago's* powder.

At the present writing, this new development is thought to have been perfected, and it is believed that the difficulty with powder for this caliber will now disappear as completely as the difficulties have already disappeared with that for the 6-inch and 5-inch calibers.

Four samples have been tried in the 10-inch gun with varying degrees of promise.

It is impossible to say when there will be any considerable quantity of suitable powder available for this caliber, but I do not anticipate any very great delay.

The sphero-hexagonal powder adopted three years ago for the 6-pounder Hotchkiss gun, and which gave such admirable results in that caliber, has been found unsuitable for the 3-pounder, principally because, owing to the very long and narrow cartridge case used with the latter gun, much space is lost in packing sphero-hexagonal grains.

It has been found impossible to use in this case the full charge of the gun or to realize quite the full velocity desired. These facts having been fully established, a new form of grain was tried and has given results entirely satisfactory. This grain is about the size of the French C_2, but differently shaped being square and flat instead of cubical. Its granulation is about 280 and its specific gravity 1.725.

This powder packs easily in the case and burns with great regularity.

It being thought desirable that one powder should be used for both the 3-pounder and 6-pounder guns, experiments have been made in the latter to determine if this grain might be used in that gun also. It is found to give the velocity required with a very moderate prsesure and will probably shortly be adopted.

In June last two samples of powder manufactured by the Laflin and Rand Powder Company were tested in the South Boston 6-inch breech-loading rifle. The results given in this gun by one of the two lots being thought encouraging, a round was fired with this sample from a standard 6-inch gun, as follows: Charge, 40 pounds; initial velocity, 1,857 foot-seconds; pressure, 18 tons. This is a higher pressure than would be given for a corresponding charge and velocity by an ordinary black powder.

It would therefore seem that the means adopted in manufacture to slow the burning of the powder had in fact quickened it.

HIGH EXPLOSIVES.

In June of the present year, two series of experiments were undertaken with high explosives, the object being to determine whether or not the explosives in question could be fired with safety from powder guns. The first series was with material received from the torpedo station, the second with the so-called "inert nitro-glycerine" of Mr. S. D. Smolianinoff.

The first experiments were a continuation of others already made at the torpedo station, and in carrying them out we had the benefit of the assistance of Lieut. Karl Rohrer and Prof. C. E. Monroe, of that station.

It was proposed to try as a bursting charge for shells, first, gun-cotton; second, a special explosive designated as "A."

The gun used was a 6-inch South Boston gun.

The firing with gun-cotton was unavoidably interrupted before it had progressed so far as to warrant a conclusion, and before it could be resumed the gun had been destroyed by an explosion in the bore of a shell loaded with explosive "A."

I think the failure to reach a conclusion as to the suitability of gun-cotton for use as an explosive in shells is greatly to be regretted, and I beg to renew my recommendation that a number of special shells be made for the 8-inch M. L. R. to take the standard disks of gun-cotton, and that the experiments in this direction be resumed with that gun.

Mr. S. D. Smolianinoff presented a mixture of nitro-glycerine with a substance which, as it was claimed, rendered the explosive entirely safe except under the action of a detonating fuze. Three shells loaded with this mixture were fired from the 8-inch M. L. R. The shells were not fuzed.

There was no explosion in the gun. The first two shells did not explode at all. The third exploded on impact with the water. As this explosion was quite unexpected by the inventor, it was thought to throw much doubt upon the safety of his mixture, and the firing was suspended to await the further orders of the Bureau.

It has not since been safe to resume this firing even if the Bureau had desired to resume it.

RANGING.

Three range tables have been constructed by taking advantage of the very rare occasions when firing over the range has been practicable. Two of these tables are

for the 5-inch B. L. R. with the service velocities, 2,000 foot-seconds and 1,70[illegible] seconds, and one for the 8-inch with 1,700 foot-seconds.

I have been anxious to complete the range work for the calibres thus far is[illegible] service by constructing from practice an 8-inch table for 2,000 foot-seconds [illegible] velocity; but no occasion has been found when the necessary firing could be [illegible] done. The calculated table now in use for the full velocity with this gun shoul[illegible] accurate for ranges up to about 3,500 yards, and not seriously in error beyond [illegible] point and up to 5,000 yards.

A Maxim automatic gun was received and tested here in March last. Unfortun[illegible] this gun while embodying perfectly the principle of the invention which it re[illegible] sented, was mechanically imperfect in many details, the gun, under the manip[illegible] tion of the agent who accompanied it, acting much less perfectly than could h[illegible] been desired. Its performance was nevertheless very remarkable, and left no d[illegible] upon my mind of the great merit of the system.

Much of the time of the station has naturally been occupied with routine w[illegible] such as the testing of materials for gun-carriages, gun-shields, etc., the proof [illegible] service powder, the firing of experimental shell, shrapnel, etc., and the testin[illegible] inventions submitted to the Bureau for its adoption. Upon all of these details [illegible] ports have been made.

Much attention has been given also to the settlement of questions regarding [illegible] service of the new armament under conditions prevailing on shipboard, the work [illegible] of carriages, of gas checks, and of primers, the difficulties likely to arise, and [illegible] means of preventing or correcting them.

In connection with the test of guns, carriages, and powder an instrument has b[illegible] designed and tested for measuring velocities and acceleration of recoil. In gen[illegible] terms this consists of a horizontal cylinder revolving with a known and const[illegible] velocity, along the surface of which, in the line of its axis, a pencil is carried by [illegible] motion of the recoiling carriage. This instrument, in principle, was of my de[illegible] but its present satisfactory working is due to an important modification intro[illegible] by Ensign R. B. Dashiell, who reported for duty at the station shortly after my [illegible] experiments with it had been made.

In closing this report of the yearly work of the proving ground, I venture to [illegible] attention to the difficulties under which it has been accomplished and to the d[illegible] which are constantly entailed by the exposed situation of the station. Ther[illegible] hardly any part of the work done here which is not accompanied by danger mor[illegible] less serious.

In reviewing the work of the past six years, I feel it very remarkable that no a[illegible] dent has ever occurred, and I am unable to believe that even the extreme [illegible] cautions which have so far secured this immunity from accident can always ava[illegible] insure it.

I am aware that the subject of a suitable site for a new firing ground has long [illegible] gaged the attention of the Bureau, and that only the extreme difficulty of findi[illegible] site which shall combine the many characteristics needed has delayed the decis[illegible] I have given the subject much consideration, and have personally visited m[illegible] places which have seemed promising, with results which are known to the Burea[illegible]

It seems to me not improbable that, in the end, it will be necessary to maintain [illegible] stations—one near Washington, for such work as can be safely done at the plac[illegible] be selected; the other at a greater distance, for such work as calls for a long and [illegible] range.

If the station is to remain here for more than another year, considerable mo[illegible] should be spent in repairs and improvements, as, anticipating an early change of [illegible] I have for the past two years avoided making any extensive repairs or changes.

Respectfully, etc.,

AUSTIN M. KNIGHT,
Lieutenant-Inspector Ordnance, in Charg[illegible]

CHIEF OF BUREAU OF ORDNANCE,
Navy Department, Washington, D. C.

UNITED STATES NAVY-YARD, WASHINGTON.

REPORT OF PROGRESS MADE AT THE NAVY-YARD, WASHINGTON, ON THE CONSTR[illegible] TION OF THE BUILDINGS, ETC., FOR THE NEW GUN FACTORY, FOR THE YEAR [illegible] ING OCTOBER 31, 1888.

8-inch gun shop.

Clearing out anchor shop.—Under this head, since November 1, 1887, a large am[illegible] of work has been done. The floors of this building, of unequal height, have been [illegible] cavated to an average grade of about 15 inches below the proposed finished floor [illegible]

of the gun shops. This has involved a great deal of labor, the south end requiring the removal of foundations of forges, hammers, engines, cranes, furnaces, etc., and at the north end the breaking up of the foundation of the Nasmyth hammer, which, built of stone and huge oak beams, banded together by numerous 3-inch iron bolts, was a costly and difficult undertaking. Two large furnaces in this part were also removed.

Works of reconstruction.—The cross and north end walls of this shop have been taken down, the bricks cleaned and utilized in other work of reconstruction, and the stone from the heavy foundations placed in the retaining walls of the 12-inch gun shop. The work of raising the roof 6 feet to give greater head room for the cranes has been completed. Two new wood and iron trusses have been erected. The south end of the roof has been reslated. New gutters have been made and put in place, and general repairs made wherever needed. The glazed skylight, which fell in February last, has been reframed in a much stronger manner than before, and thoroughly flashed and fitted with ventilating, swinging shutters. Two-thirds of the windows have been rehung. At the south end the work of enlarging the central door has been commenced and a new cast-iron lintel put in place. At the north end, east side, connection has been made with the 12-inch gun shop, and the wall of the 8-inch gun shop has been underpinned carefully with a concrete foundation. On the west side, where about 50 feet of the north end of the wall had to be torn down in consequence of the sinking from the shrinking pit excavation, advantage has been taken in rebuilding to secure a plain wall on the inside, the pilasters being omitted, and, in connection with this, the north doorway has been cut down to the level of the floor. Under this part of the wall a pile and concrete foundation was placed, the earth being very much disturbed. On the 1st of November, 1887, but few of the piers of the 40-ton crane were in place. During the year all the rest have been laid. This has been a matter of considerable difficulty and expense. The removal of the foundations met with in excavating has necessitated the expenditure both of time and money far in excess of what was anticipated. The character of the ground at the south end on the west side made piling necessary for the odd-numbered piers 1 to 19, while the complete disintegration of the soil at the north end by the sinking due to the excavation for the shrinking pit made it also necessary for piers 47 to 52, 53 and 55.

In all these 281 piles have been driven.

In addition it was found necessary to increase the base area of several piers to insure a firm foundation for the crane supports, increasing both the excavation and the amount of concrete laid.

At this date, October 31, 1888, all the piers are ready for the iron-work to No. 36, and all will be ready by the end of the second week in November.

12-inch Gun Shop.

At the beginning of the year ending October 31, 1888, the work of excavating for site of this shop was being rapidly carried on, and was continued with interruption only from the bad weather, until the entire area had been brought practically to grade of the finished floor, being left thus high on account of the character of the clay, which slacked and deteriorated with either dryness or moisture. The labor of excavating was materially increased by the necessity shown by the caving in of the hitherto firmly standing clay banks, which commenced with the heavy rains of October, November, and December, 1887, for extensive bracing, both as a preventive of further giving way of the walls and as a protection for the workmen.

With every precaution taken long-continued storms washed out large masses of and so softened the earth as to necessitate a material increase in the amount of masonry in places. But with all these disadvantages the retaining-walls have been completed without accident, and exposure to many months of wet and dry have demonstrated their safety and good construction. In connection with the east and west retaining-walls have been built stone stairways, which will, when the walks about the building are completed, form convenient thoroughfares for the workmen of the yard.

East of the 12 inch shop a brick retaining-wall has been built about an area, so as to give light to the windows at the southeast corner and secure a dry wall to the building.

Work upon the shrinking pit was commenced early in January, 1888. Numerous borings previously made in the immediate vicinity of the pit to a considerable depth had shown the existence of a compact bed of clay, apparently bearing no water. This examination was confirmed by the first 15 feet excavated, but at this depth water made its appearance, and at 22 to 26 feet a stratum of quicksand was struck, from which the flow of sand into the pit did not cease until the 13th of July, when the pipes which had been placed through the concrete walls in construction to carry the water were plugged.

Every precaution possible was taken both to prevent and regulate this flow, but, as the sand found its way through the minutest crevice wherever water could run, without success.

The quantity of sand thus coming in was enormous, frequently a half day's la being expended in removing it and the water before a shovel could be put into clay beneath. In consequence of this flow the ground in the vicinity of the pit a began to sink, extending farther and farther and to greater depth, until it invol the foundations of the north part of the west wall of the 8-inch gun shop and south part of the corresponding wall of the 12-inch gun shop, and several of the p for the crane supports. Besides there arose the necessity of extra bracing. and pit was filled so as to leave scarcely room for the buckets, with piles braced aga horizontal beams which held back the vertical sheathing. This, however, would have involved undue labor but for the sinking of the ground above described, w amounted to over 10 feet at the southwest corner of the pit. This threw the bra out of line, transferred stresses in a very preplexing way, decreased the size of th by the dipping of the piles and braces, and at length caused the caving in of the side, April 26 and 27, 1888, when the clay backing had become so softened by the w which entered the pit from the center of the south side to the northwest corner readily flow, pushing out between the sheathing, permitting the braces to shift, the end at last to give way. Even so recently as July 23, 1888, the north bank o shallow part, full of seams, inclined toward the pit, and, wet with rains, cave just before the bracing was to be put in, fortunately during the noon hour, whe one was at work.

Though the soil has been most treacherous and the work in consequence dange to an extent little understood or appreciated, the labor of excavating and of la the concrete has been successfully completed without accident to any one, the ca in having all happened at times when no one was in the pit. At this date the crete walls are finished, the plank lining is being removed, and the pit is b pumped out ready for the iron caissons and for fitting up with the interior arra ments as planned by the Bureau of Ordnance, and for the laying of the granite co

The concrete foundations for the walls of the 12-inch gun shop were laid in vember and December last. The foundation courses of brick were begun Apr 1888, and since then the water-table has been laid and the walls practically pleted. In erecting them pipes were introduced to receive the bolts from the braces of the columns of the 110-ton crane, so as to avoid, as much as possible, drilling through the walls. There yet remains the finishing of the cornice on the side, and the building up of the pilaster about the east heel of the new truss a north end of the 8-inch gun shop, which will require but a few days longer, an filling in about the iron works of the shed roofs of the main building, which can be done after it is in place.

The shed of the 12-inch gun shop, between it and the retaining-wall, has been ered in ready for tinning, which will be done when the walls of the large shop completed. The iron columns and I beams for this shed are being fitted by Ordn and will soon be put in position, the foundations being already in. In the j shop all the frames for the windows of the main building are made, and work is going on upon those intended for the clear-story.

The concrete piers for the 110 ton crane supports are nearly complete, all but requiring only surfacing to grade to finish. They will be ready for the erectio the columns within a fortnight.

With the approval of the Chief of Ordnance, a new sewer of 10-inch glazed pip been laid about the 12-inch gun shop, to take the place of a large cement pipe s cut off by the shrinking pit excavation, and so far it has proved ample to carry o the drainage. In connection with this several new catch basins have been set area south of the shed between the 12-inch gun shop and the retaining-wall has graded and paved, and sidewalks laid, as also a gutter east of the main retai wall. The same improvements are now being made north and west of the 12- gun shop, and will probably be completed before winter sets in.

In the gun-carriage shop a large amount of labor has been done removing cr machinery, galleries, etc., including foundations. Considerable excavation has made in connection with this, to bring the general level about to that require concreting, except in the center, where the railroad track is still in use. The c wall has been torn down to the level of the second story, the bricks cleaned and up in various works of improvement. A new wooden truss has been erected over cross-wall. At the north end the badly sagged hip truss has been taken out, a place of it the shorter and stronger partial trusses have been continued acros building and a new truss built where it was needed. The attic floor has been t down and the material coming from it used for sheathing in the shrinking pit an scaffolding. The forge chimneys, at the south end, have been taken down abov roof, and the openings temporarily covered, pending the repairs to the trusse which the scaffolding is now being erected.

25-ton crane supports

These are complete for piers Nos. 1 to 22, and ready for the iron-work. Un difficulty was experienced in the laying of these. The soil is all made earth, a

very porous, so that the flow of water from one pit to another was very great, and pumping of one excavation involved practically the pumping of all. Besides, owing to this large amount of water, the caving in of the earth was frequent beneath the hard-packed surface, and at least double the amount of excavation anticipated required.

Steam conduit.

Three hundred and twenty-five feet of steam conduit has been laid from the battery of boilers in the breech mechanism shop to the foundry. It is fitted with proper outlets to sewers, and with wells for catching surface water where necessary, and works satisfactorily supplying dry steam to the various engines of the foundry.

Respectfully submitted.

A. G. MENOCAL,
Civil Engineer, U. S. N.

RECORD OF PROCEEDINGS OF TORPEDO BOARD FROM NOVEMBER 1, 1886, TO JUNE 30, 1887.

November 30, 1886.

The Board met in accordance with orders from the honorable Secretary of the Navy (marked A) and the senior member (marked B), and organized as follows: A. P. Cooke, captain, U. S. Navy, president; C. F. Goodrich, commander, U. S. Navy, member; R. B. Bradford, lieutenant-commander, U. S. Navy, member; A. R. Couden, lieutenant, U. S. Navy, member; S. P. Comly, lieutenant, U. S. Navy, member.

All the members present. The order constituting the Board and a letter from the agent of the Howell Torpedo Company, with indorsement of the Bureau of Ordnance (marked C), were read by the president. After discussion it was decided to defer the selection of the northern locality for the trials of automobile torpedoes for the present and to advise the sending of one member of the Board (Lieutenant Couden) to the vicinity of Pensacola and Key West for the purpose of making a preliminary inspection of such localities there as may seem suitable for winter trials, he to be furnished with facilities for such inspection and to report to the Board in full, when the final choice will be made by it.

A letter embodying these suggestions to be written by the president to the Chief of Bureau of Ordnance. (Marked D.)

At 11.45 a. m. the Board adjourned subject to the call of the president.

NAVY-YARD, NEW YORK,
January 25, 1887.

The Board met pursuant to orders from the president (marked E). All the members present except Lieutenant-Commander R. B. Bradford, who was absent on account of the non sailing of the Newport boat.

After discussion (see F) the vicinity of Pensacola, Fla., was selected as a suitable locality for winter experiments with automobile torpedoes.

At 4 p. m. the Board adjourned subject to the call of the president.

NAVY-YARD, NEW YORK,
April 21, 1887.

The Board met pursuant to orders of the president (marked G), all the members being present.

The communications received by the president since the last meeting were read and considered. They are as follows:

Instructions for the Torpedo Board of April 4, 1887. (Marked H*.)

Letter from the Bureau of Ordnance, April 4, 1887, to owners, inventors, etc. (Marked H.)

Letters from the president of the Howell Torpedo Company, together with notes on the Howell torpedo, its horse power, etc. (Marked H 1, 2, 3, 4, 5, 6, 7, 8, 9.)

Letter from General H. Berdan, with short description of his torpedo and photograph of model. (See report on the Berdan system of torpedoes, forwarded to Bureau September 28, 1887.)

Letter from Mr. Dana Dudley, of Lynn, Mass. (See report on Mr. Dana Dudley's torpedo, forwarded to Bureau October 28, 1887.)

Letter from Mr. Benjamin C. Pole, Philadelphia, Pa. (Marked I.)

After discussion, it was decided that the president of the Howell Torpedo Company should be requested to comply with paragraph 11, instructions to Torpedo Board.

That General H. Berdan be informed that the Torpedo Board would be convened on the 5th of May for the purpose of meeting him. That Mr. D. Dudley's inventions were not presented to the Board in such a manner that their merits could be considered, and that he be so informed. That Benjamin C. Pole should be informed that the Board was ready to receive and consider any plans he might submit coming under the scope of instructions for the Torpedo Board. That the targets should be made of netting, in sections 25 feet long by 12 feet deep, the meshes to be rectangular, 12 inches deep, the verticals to be of light woven stuff about the weight of lead lines, and the horizontals to be of netting twine. Roping of 12-inch stuff all around each section. Ordinary net floats and weights at top and bottom, respectively. Decided to request that orders be issued to Lieut. S. P. Comly to make an inspection of the waters of Long Island Sound and Narragansett Bay for the purpose of selecting a place suitable for experiments with finished torpedoes.

The Board then adjourned subject to the call of the president.

LYCEUM, NAVY-YARD, NEW YORK.
May 6, 1887.

Board met pursuant to call of the president (marked K K 1). All the members present except Commander Goodrich, absent on account of illness. Stenographer also present. Mr. H. Berdan came before the Board to explain his torpedo with snubbing line. (See report on the Berdan system of torpedoes, forwarded to Bureau September 28, 1887.)

At 12.30 Mr. Berdan withdrew. Received telegram from Commander Goodrich stating he was too ill to start last night. Read letter from Louis Bagger (marked K 2), also specification of his patent for primer of submarine torpedoes, etc. (Marked K 3.)

Decided to inform Mr. Bagger that an examination of his primer did not come within "Instructions for Torpedo Board." (Marked K 4.) Read Ordnance Bureau's indorsement on letter of president of Board requesting that orders might be issued to Lieutenant Comly to search for northern locality for torpedo trials. (Marked K 5.)

Read letters from Frank Tompkins and president of board's answer to same. (Marked K 6, 7, 8.) Read letters from Mr. Dana Dudley, also president's letters to him. Decided to inform him that when he offered a completed weapon ready for trial stated when and where he desired the trials to take place the Board would make experiments; also, to request him to send a communication to the Board stating exactly what the torpedo would do. (See report on Mr. Dana Dudley's invention, forwarded to Bureau October 28, 1887.)

Read letter of president to W. L. D. O'Grady, also letters from Mr. O'Grady and Bureau of Ordnance regarding "flying pontoon." Decided to inform Mr. O'Grady that if he will report to the president of the Board when he has finished contemplated alterations to the flying pontoon the Board will inspect it at Roslyn, but can not set the date at present. (See report forwarded Ordnance Bureau June 13, 1887.) Read letters to Howell Torpedo Company, also letters from Howell Torpedo Company and specifications of patents. (Marked H 1, 2, 3, 4, 5, 6, 7, 8, 9.)

Decided to try the Howell torpedo. To so inform the Bureau of Ordnance and to request that a vessel of suitable character be placed at its disposal. Vessel to carry 60 to 80 pounds of steam and to be able to furnish sufficient quantity for experiments. To have large enough crew for conducting experiments. Authority requested to employ labor for installing torpedo. (Marked L.) Decided that Noyack Bay in vicinity of Sag Harbor was suitable locality for preliminary trials of torpedoes during summer months, and that late trials from vessels under way should be made in Gardiner's Bay or Long Island Sound. (Marked M.)

Read letters from Messrs. Hunter and Kenyon, together with illustrated pamphlet describing submarine vessel and fish torpedo.

Read letters of president of Board to Mr. Kenyon (see report on "Hunter fish torpedo" sent to Bureau October 29, 1887).

At 3.50 p. m. Board adjourned to meet to-morrow, the 7th inst., at 10 a. m.

LYCEUM NAVY-YARD, N. Y.,
May 7, 1887.

The Board met pursuant to adjournment of yesterday. All the members present.

Decided to inform Mr. Hunter that agreeably to the request of Mr. Kenyon the Board would meet at his office, in Philadelphia, about 11 a. m. of the 20th instant, for the purpose of examining his fish torpedo. (See N.)

Timothy Sullivan, machinist U. S. Navy, came before the Board and presented drawings of his submarine rocket torpedo for firing from directing tubes through

ship's side, and gave oral description of same. He was requested to furnish the Board with a full description of torpedo. He withdrew.

President of the Howell Torpedo Company came before the Board and suggested that the vessel from which experiments are to be made should carry from 60 to 80 pounds of steam, and should have at least five men in addition to her regular crew. One machinist to handle and work torpedo.

One laborer to assist in handling torpedo, and three men for handling boats, targets, etc.

President Howell Torpedo Company withdrew.

Board adjourned subject to call of president.

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926 WALNUT STREET, PHILADELPHIA, PA.,
May 20, 1887.

The Board met pursuant to orders of its president (marked N. 1, 2) for the purpose of inspecting the Hunter fish torpedo.

All the members being present, Mr. R. Hunter gave a brief description of his submarine boat, having two models to illustrate his remarks. He stated that the propelling instrument (immersed side-wheels with feathering floats) was the principal feature of his invention. The main object being to control the boat without complication, he claimed to be able to move in any direction (ahead, astern, down, up, turn on the center, etc.), without changing the direction in which the shaft was revolving. The feathering arrangement consisted of a sleeve on the shaft which gave motion to an idler which turned a pinion with each float, the float making half a revolution to one complete revolution of the wheel. One man governs the whole boat by means of a hand-wheel having a pointer in front of him which traverses a dial and shows the exact angle of the floats.

The inventor claims that very little power is required to change the angle of the ats, and that they can be locked in any position. He had not decided upon what tive power to use to drive the boat but thought of a fireless engine or electricity.

Neither the probable speed nor the effective power of boat has been calculated. In actual practice he stated the speed was surprising. With same horse-power obtained great excess of speed over ordinary modes of propulsion.

When on the surface the boat is to be ventilated by means of a pipe shot up above the deck through which the foul air is pumped out and pure air pumped in.

The inventor proposed to apply this propeller to a fish torpedo, but no arrangement for launching the torpedo from the ship had been designed.

A number of experiments were made with both models in a tank (16 feet by 3 feet by 3 feet) filled with fresh water.

(1) To sink directly down; successful.

(2) After being loaded to come to surface; successful.

(3) Move straight ahead, varied a little; said to be on account of different sized paddles.

(4) Move directly astern; fairly successful.

(5) Turn on center as pivot; successful.

(6) Go down slowly in incline; successful.

About same experiments with small model; fairly successful. Both models worked by clock-work.

ROSLYN, LONG ISLAND, *May* 27, 1887.

The Board met, pursuant to orders of its president, at the ship-yard of Mr. Thomas Clopham, for the purpose of inspecting the "flying ponton" of Mr. O'Grady. (See O, O 1, O 2, and O 3.)

All the members present except Lieut. A. R. Couden, U. S. Navy. Mr. O'Grady also present. Inspected a model of the "flying ponton" (15 feet by 5 feet by 7 inches), Mr. O'Grady giving a brief description of it and the purposes to which he considered it adapted.

He was requested to furnish the Board with a written description of his invention and to state how he would use it.

Adjourned to meet at 10 a. m. to-morrow.

LYCEUM NAVY-YARD, N. Y., *May* 28, 1887.

Board met pursuant to adjournment of yesterday, all the members being present except Lieut. A. R. Couden, U. S. Navy.

Read and considered letters from Mr. Dana Dudley. (See report forwarded to Bureau.)

Decided to inform him that the Board was organized for the purpose of making experiments and that it had no gun which it could place at his disposition; that it could see nothing in his designs which had not been well digested already, except the throwing of a high-power explosive projectile by means of compressed air, the air to be compressed at the moment of firing by the explosion of a charge of gunpowder; that if he had any good working apparatus to demonstrate this; the Board will be pleased to witness any experiments at such time and place as may be decided upon hereafter.

Discussed the Hunter fish torpedo, but decided to defer final action.

Read and considered letters from Lieut. M. E. Hall (marked P) and H. Berdan.

At 12.30 p. m. the Board adjourned, subject to call of its president.

LYCEUM NAVY-YARD, NEW YORK,
June 10, 1887.

At 10 a. m. the Board met, pursuant to the orders of its president (see Q Q 1).

Present, all the members.

Read and considered letter of May 31, 1887, from W. L. D. O'Grady, giving description of flying pontoon, its adaptation to naval purposes, etc. (See "Report of Flying Pontoon," June 13, 1887.)

After discussion, letter to H. Berdan was prepared. (See R and report of September 28, 1887.)

Letter from Mr. Patrick was read and discussed. (See S.) Decided to send letter to Mr. Patrick. (S 1.)

Board adjourned subject to call of its president.

NAVY-YARD, NEW YORK.
June 24, 1887.

At 10.15 a. m. the Board met, pursuant to orders of its president (see T T 1, T 2).

All the members being present, accompanied by Mr. Patrick, proceeded to College Point, Long Island, in the navy-yard tug, for the purpose of witnessing a run of the "Patrick" torpedo. The torpedo was found in a boat-house having an inclined railway running into it from the water.

Mr. Haight, Mr. Wood, and four laborers, all employés of Mr. Patrick, were present preparing the torpedo for launching. Watches were compared and a member of the Board went out to the mile buoy in a small boat. A system of signals having been arranged, by which the observers at the beginning and end of the course could tell the instant of passing the first buoy and of arrival opposite the mile buoy, the torpedo was launched and started over the course between the buoys.

The mile (5,280 feet) was made in 3 minutes 16 seconds, or 26.79 feet per second; 15.84 knots per hour.

The water was smooth, wind blowing with force of 3 across the course, and there was a small tide against the torpedo.

Torpedo passed close to the buoy, was stopped at end of run, electric wire cut, and torpedo towed back to the boat-house from which it had been launched.

The covers were then taken off the different compartments and brief descriptions were given of the parts by Messrs. Patrick, Haight, and Wood. Mr. Patrick stated that no changes had been made in torpedo since Lieutenant-Commander Newell had obtained a description of it, a copy of which is in possession of the Board, with the exception of the reduction in size of some of the heater tubes. (Half were now 1-inch diameter, and half ¾-inch diameter.) Mr. Patrick also stated that his torpedoes were designed principally for harbor defense, and that he proposed using them in batteries of four or five sent out from a shore station.

At 4 p. m. the Board left College Point for New York.

Read and considered communication of June 14, from Remington & Henthorn, submitting the torpedo of H. P. Griswold. (See U.)

The Board adjourned subject to the call of its president.

APPENDIX.

A.

NAVY DEPARTMENT,
Washington, D. C., August 20, 1886.

Section 10 of the act of Congress to increase the naval establishment, ap- August 3, 1886, authorizes the expenditure of $75,000 for the purpose of cturing, purchasing, and experimenting with torpedoes of domestic manufact-

re appointed senior member of a board of officers to carry out the object of tion, so far as it relates to this subject. You will receive instructions con- the duties of the board from the Chief of Bureau of Ordnance, with whom l be pleased to communicate.

ander C. F. Goodrich, Lieutenant-Commander R. B. Bradford, and Lieuten- R. Couden and S. P. Comly will be associated with you as members of the

y of the act referred to is inclosed herewith.

ery respectfully,

J. G. WALKER,
Acting Secretary of the Navy.

in A. P. COOKE,
ommanding U. S. R. S. Vermont, Navy-Yard, New York.

A 1.

AN ACT to increase the naval establishment. Approved August 3, 1886.

* * * * * * *

10. That towards the construction and completion of the hereinbefore men- including the vessels and guns mentioned in section nine, the sum of two mill- hundred thousand dollars is hereby appropriated, of which not more than -five thousand dollars may be expended in manufacturing, purchasing, and nting with torpedoes of domestic manufacture and not exceeding one hun- fifty thousand dollars may be expended, under the direction of the Secretary Navy, in improving the plant of the navy-yard as he may select.

above act referred to in the letter from the Secretary of the Navy, August

B.

NAVY-YARD, NEW YORK,
November 19, 1887.

You will report on the 30th instant at the Navy Department, Washington, D. apt. A. P. Cooke, U. S. Navy, president of Torpedo Board, for duty in connection lecting localities suitable for making trials with auto-mobile torpedoes.

ery respectfully,

A. P. COOKE,
Captain U. S. Navy, President of Torpedo Board.

Commander C. F. GOODRICH, U. S. N.,
Torpedo Station, Newport, R. I.

Lieutenant-Commander R. B. BRADFORD, U. S. N.,
21 Brinly street, Newport, R. I.

Lieut. A. R. COUDEN, U. S. N.,
Bureau of Ordnance, Washington, D. C.

Lieut. S. P. COMLY, U. S. N.,
League Island Navy-Yard, Philadelphia, Pa.

B 1.

NAVY-YARD, NEW YORK,
November 23, 1886.

The order of the 19th instant, convening the Torpedo Board, is so far modi- t the place of meeting will be the navy-yard, New York, instead of the Navy ment, Washington, D. C.

ery respectfully,

A. P. COOKE,
Captain U. S. Navy, President of Torpedo Board.

Commander C. F. GOODRICH, U. S. N.,
Torpedo Station, Newport. R. I.

Lieutenant-Commander R. B. BRADFORD, U. S. N.,
21 Brinly street, Newport, R. I.

Lieut. A. R. COUDEN, U. S. N.,
Bureau of Ordnance, Washington, D. C.

Lieut. S. P. COMLY, U. S. N.,
Navy-Yard, League Island, Philadelphia, Pa.

B 2.

U. S. R. S. "VERMONT."
Navy-Yard, New York, August 21, 188.

SIR: I have the honor to state that I have been appointed senior member of a board in connection with certain expenditures for torpedoes, and have been directed to communicate with the Chief of Bureau of Ordnance, from whom I am to receive instructions. My address is No. 29 Sears Building, Boston, Mass.

Very respectfully,

A. P. COOKE.
Captain, U. S. N.

Commodore MONTGOMERY SICARD, U. S. N.,
Chief of Bureau of Ordnance, Navy Department, Washington, D. C.

C.

PAWTUCKET, R. I., *November 8, 1886.*

SIR: Referring to the Bureau's circular of September 8, 1886, I beg to state that we have in readiness for trials the Howell automatic fish-torpedo, of length 8 feet 6 inches, weight 315 pounds, charge of explosive 70 pounds.

I respectfully ask for further information, and if a course has been selected in reference thereto I will submit the following notes on localities at the north and the desirable characteristics for trials of this torpedo, and request the co-operation of the Torpedo Board in laying a suitable course for arranging for trials at such point as the Bureau may prefer.

As to range.—Our range in Kettle Cove, north side of Naushon Island, is 700 yards long. The torpedo now runs beyond the range at half power against a current. We are gearing up to limit the range at full power to 600 yards, while still showing the high speed. This is for convenience of sighting and recovering torpedo at end of run owing to the limited nautical material at our command. The best average development of power is on a range of 1,000 yards.

Depth of water and bottom.—For adjustment trials and to note range and action, the depth should be from 3½ to 6 fathoms, clear water preferable to observe the torpedo as it runs to adjusted depth and to note speed. Sandy bottom is desirable, as the motion is irregular at end of run when the power is exhausted, and the torpedo might stick in the mud. The less current the better, and eel grass, if any, should be removed.

Surroundings.—The trial ground must be protected from wind and sea, in view only of recovering the torpedo at end of run and hoisting it on board. It shows but little above the surface, having a few pounds buoyancy, and a small wave may hide it from view. If in a current it would then be swept away.

The width of channel may be small, as the directive force prevents deflection until power is expended.

Localities.—Gloucester and other harbors north of Boston have either rocks, strong currents, grass, or muddy bottom. No suitable place was found in Boston Harbor or Bay. Plymouth has Warren's Cove, sandy bottom, clear water, little current, protected from south and west, also west of Gurnet light-house, and inside Long Beach, have sometimes swift currents, otherwise favorable.

Nearest tug, Boston. Provincetown Harbor has a good trial ground, protected from north and west. No tug convenient.

Billingsgate Harbor, likewise. Too much current at times.

There are no other suitable places on Cape Cod. Kettle Cove, Buzzard's Bay, has clear water, sandy bottom, protected from south and east; considerable current. Nearest point for the tug, etc., New Bedford. Usually rough at crossing at this season.

We have found no other suitable place in Narragansett Bay or elsewhere, but the collector of Sag Harbor writes that a cove northeast of Hog Neck and other points in Peconic Bay have the characteristics demanded. No tug in the vicinity. I will visit this locality shortly, and will, if desired, report the result of inspection. As to protection from wind and sea, it appears to be the best place North.

Very respectfully,

F. H. PAINE,
President Howell Torpedo Company.

MONTGOMERY SICARD, U. S. N.,
Chief of Bureau of Ordnance.

C 1.

[The Bureau's first indorsement on the letter from the president of the Howell Torpedo Compan., dated November 8, 1886, in relation to place for trial of his torpedo.]

BUREAU OF ORDNANCE, *November* 16, 1886.

Respectfully referred to the Torpedo Board.

Please select two localities suitable for running the Howell or any other automobile torpedo having not less than 10 feet submergence and a range of 1,000 yards.

One location may be at the North, and the other may be far enough south to be used in the winter.

The conditions mentioned herein should be regarded in making the selection, which you will please report to the Bureau when decided upon.

M. SICARD,
Chief of Bureau.

C 2.

NAVY-YARD, NEW YORK,
November 19, 1887.

: I have the honor to acknowledge the receipt of a communication from the lent of the Howell Torpedo Company, with an indorsement by the Bureau of ance under date of the 16th instant, directing the Torpedo Board to select locali- suitable for torpedo trials, and I have to report the Torpedo Board will convene the Navy Department for that purpose on the 30th instant.

Very respectfully,

A. P. COOKE,
Captain, U. S. N., President of Torpedo Board.

Commodore MONTGOMERY SICARD, U. S. N.,
Chief of Bureau of Ordnance, Washington, D. C.

D.

NAVY-YARD, NEW YORK,
November 30, 1886.

I have the honor to report that the Torpedo Board met here to-day for the e of selecting localities suitable for experimenting with automobile torpedoes. lering the season of the year the Board decided to settle first upon some suit- outhern locality, and believe that one may be found in the vicinity of Pensacola, West, or thereabout.

Board directed one of its members, Lieutenant Conden, to make a preliminary ection of this locality with a view of determining the most favorable spot. And ve to request that the Department may issue the necessary orders to Lieutenant Conden for this purpose, authorizing him to procure the needed facilities for inspect- ng the localities.

Very respectfully,

A. P. COOKE,
Captain, U. S. Navy, President of Torpedo Board.

CHIEF OF BUREAU OF ORDNANCE,
Navy Department, Washington, D. C.

D 1.

[First indorsement.]

BUREAU OF ORDNANCE, *December* 2, 1886.

Respectfully returned to the president of Torpedo Board.

It will be impossible to spare the services of Lieutenant Conden, and the Bureau requests that some other officer may be selected for the purpose herein mentioned.

M. SICARD,
Chief of Bureau.

[Second indorsement.]

NAVY-YARD, NEW YORK,
December 10, 1886.

R ctfully returned to the Bureau of Ordnance. Referring to the Bureau's first nent of December 2, 1886, I have the honor to recommend that Lieut. S. P. be ordered to perform the services indicated.

A. P. COOKE,
Captain, U. S. N., President of Torpedo Board.

D. 2.

[Third indorsement.]

BUREAU OF ORDNANCE, *December* 15, 1886.

Respectfully returned to president of Torpedo Board. Please direct Lieutenant Comly to go in search of the range herein referred to. On his return to pass through Washington and report at this Bureau and at the office of detail. At the latter his orders will then be made covering the places he has visited. He must be instructed to be careful not to cause any greater expense than necessary to attain the object in view. He should consult with officers who have surveyed the region to be visited (and with other persons) on the subject of a good location.

M. SICARD.
Chief of Bureau.

[Fourth indorsement.]

NAVY-YARD, NEW YORK,
December 17, 1886.

Respectully returned to the Bureau of Ordnance. Referring to the Bureau's third indorsement, I have the honor to state that I have ordered Lieutenant Comly to go in search of the necessary range and have given him the instructions indicated.

A. P. COOKE,
Captain, U. S. N., President of Torpedo Board.

E.

NAVY-YARD, NEW YORK.
January 20, 1887.

SIR: There will be a meeting of the Torpedo Board at the navy-yard, New York, on Tuesday, the 25th instant, for the purpose of deciding upon a suitable locality in the South, for experiments with automobile torpedoes.

You are hereby directed to attend.

Very respectfully,

A. P. COOKE,
Captain, U. S. N., President of Torpedo Board.

Commander C. F. GOODRICH, U. S. N.,
Torpedo Station, Newport, R. I.
Lieut. Commander R. B. BRADFORD, U. S. N.,
No. 19 Mann Avenue, Newport, R. I.
Lieut. A. R. COUDEN, U. S. N.,
Bureau of Ordnance, Washington, D. C.
Lieut. S. P. COMLY, U. S. N.,
League Island Navy-Yard, Philadelphia, Pa.

F.

NAVY-YARD, NEW YORK,
December 17, 1886.

SIR: In order to carry out experiments with automobile torpedoes, it is necessary to select suitable localities for running the same. Considering the season of the year the Board has decided to settle first on some suitable southern locality, and believe such a one may be found in the vicinity of Pensacola, Key West, or thereabout.

You are hereby directed to make a preliminary inspection of this locality with a view of determining the most favorable spot.

The trial ground should be protected as much as possible from wind and sea, with a view of observing the torpedo and receiving it at end of run. The course should have a range of at least 1,000 yards and not less than 2 fathoms deep. The less current the better, and clear water is preferable, with a sandy bottom.

You should consult with officers who have surveyed in the region to be visited, and with other persons, on the subject of a good location.

On your return you will pass through Washington and report at the Bureau of Ordnance and also at the Office of Detail, where orders will be made out for you covering the places you have visited.

You are instructed to be careful not to cause any greater expense than necessary to attain the object in view.

Very respectfully,

A. P. COOKE,
Captain, U. S. Navy, President of Torpedo Board.

Lieut. S. P. COMLY, U. S. N.,
Navy-Yard, League Island, Philadelphia, Pa.

F 1.

NAVY-YARD, LEAGUE ISLAND, PA.,
January 12, 1887.

: I have the honor to report that, in obedience to your order of the 17th ult., I made a preliminary inspection of the ports of Pensacola, Fla., Jacksonville, and Key West, Fla., with the view of selecting a locality suitable for experi- s with automobile torpedoes.

nclude that Santa Rosa Sound, near Pensacola, is the best locality for the ex- ents, either in Fishing Bend, to the eastward of Sharp Point, or in English y Cove, the points in favor of this locality being sufficient length, breadth, and h of course, small current, water sufficiently clear to see bottom up to a depth feet, protection from wind and waves and good tug and machine shop facilities; principal objection being a muddy bottom in depth beyond 12 feet, this being a sit of silt on sand in most places, but being quite soft and sticky in some places— ng Bend for instance.

objections to the St. John's River, near Jacksonville, are very dark water, dis- from the sea (25 miles), and want of tug facilities.

e objections to Key West are want of protection from wind and waves, liability liscolored water, and poor tug facilities.

transmit herewith charts of the localities visited, together with some notes which assist you in forming an opinion as to which is the best experimental ground.

Very respectfully, your obedient servant,

S. P. COMLY,
Lieut., U. S. Navy, Member of the Torpedo Board.

Capt. A. P. COOKE, U. S. N.,
President of Torpedo Board.

F 2.

NOTES ON KEY WEST AS TO ITS SUITABILITY FOR TORPEDO EXPERIMENTS.

1. *Length of course:* 1,500 yards.
2. *Width of course:* 500 yards.
3. *Depth of water:* 12 to 30 feet.
4. *Currents and tides:* Very variable in strength and direction, depending upon wind. Average about 1 knot, extreme 2 knots.
5. *Protection from winds and waves:* Not good except from easterly winds. Wind from southward and westward make water quite rough.
6. *Clearness of water:* Water very clear at times so that bottom can be seen in 4 fathoms. At other times it becomes very cloudy with winds from westward, with fine coral dust, and remains so several days.
7. *Character of bottom:* Hard sand and coral.
8. *Character of banks:* Wharf at beginning of course, and Fort Taylor at the end, dy beach between.
Rise and fall of tides: 18 inches to 2 feet.
10. *Winds and storms:* Heavy northers occasionally. General direction during win- months northward and eastward.
11. *Average temperature*, 1886: January, 64; February, 66; March, 71.
12. *Rainy days that would interfere with outside work*, 1886: January, 8 days; Febru- , 3 days; March, 6 days.
13. *Facilities:* Poor; no tugs at all. A small job of machine work can be done at overnment machine-shops.

F 3.

TES ON ST. JOHN'S RIVER, NEAR JACKSONVILLE, AS TO ITS SUITABILITY FOR TORPEDO EXPERIMENTS.

1. *Length of course:* 1,500 to 2,000 yards.
2. *Width of course:* 500 yards.
3. *Depth of water:* 12 to 20 feet.
4. *Currents and tides:* Tides said to run 2 and 3 knots an hour. Observed about knot.
5. *Protection from wind and waves:* Very good generally, a northeast wind would ke some sea.
6. *Clearness of water:* Water very dark, can only see bottom in 2 feet.
7. *Character of bottom:* Hard and generally sandy, with occasional patches of mud ome rocks. Grass does not seem to grow in depths beyond 3 feet.
Character of banks: Left bank, beginning at Commodore Point, low and marshy y a mile, then a sandy beach backed by a 10-foot bluff for three-quarters of a

mile, then marshy. Three wharves from which observations might be taken, but the are the same distance apart.

Right bank, beginning about a mile above mouth of Pottsburg Creek. bluff w: four or five private landings from which observations might be taken. Be Pottsburg Creek banks not so favorable for observations, low bluffs and marshy.

9. *Rise and fall of tide:* 2 to 3 feet.

10. *Winds and storms:* Occasional heavy storms form northward and eastward.

11. *Average temperature* 1885: January, 56.2; February, 54.3; March, 57.6.

12. *Rainy days that would interfere with outdoor work*, 1885: January, 16 days: F ruary, 9 days; March, 11 days.

13. *Facilities:* Not very good; only two small tugs that are allowed to carry m than 60 pounds of steam. Good machine-shops. Distance from the sea, 25 miles.

F 4.

NOTES ON SANTA ROSA SOUND, NEAR PENSACOLA, AS TO ITS SUITABILITY FOR T PEDO EXPERIMENTS.

1. *Length of course:* 1,500 yards.
2. *Width of course:* 500 yards.
3. *Depth of water:* 12 to 20 feet.
4. *Currents and tides:* Small in Fishing Bend and to the eastward of Sharp Pt Stronger in English Navy Cove.
5. *Protection from wind and waves:* Fishing Bend and Cove to the eastward of Sl Point, well protected from almost any wind. English Navy Cove not so well tected from easterly winds.
6. *Clearness of water:* Clear enough to see bottom in 12 feet where bottom is s
7. *Character of bottom:* Generally sandy, with patches of short grass in depth than 12 feet, above 12 feet generally a light deposit of silt on sand. In some pl however, quite muddy and sticky.
8. *Character of banks:* Sandy shore with sand dunes 15 to 20 feet high back on Santa Rosa Island. English Navy Bay, sandy shore, backed by low bluffs pines.
9. *Rise and fall of tide:* 18 inches to 3 feet.
10. *Winds and storms:* Very few heavy storms, generally from northward and ward to southward and eastward.
11. *Average temperature*, 1886: January, 49.5; February, 55.2; March, 57.9.
12. *Rainy days that would interfere with outdoor work*, 1886: January, 5 days; ruary, 2 days; March, 7 days.
13. *Facilities:* Good; several large tugs carrying from 60 to 90 pounds steam. chine work can be done at navy-yard or at private shops.

F 5.

NAVY-YARD, NEW YORK,
January 26, 1

SIR: I have the honor to report that the Torpedo Board has selected the wat the vicinity of Pensacola as a suitable winter experimental ground for practice auto-mobile torpedoes, and the Board is now ready to carry out any experiments these weapons that may be considered desirable.

Very respectfully,

A. P. COOKE,
Captain, U. S. Navy, President of Torpedo Bo

CHIEF OF BUREAU OF ORDNANCE,
Navy Department, Washington, D. C.

G.

OFFICE OF THE TORPEDO BOARD,
Navy-Yard, New York, April 16, 1

SIR: There will be a meeting of the Torpedo Board at this yard on Thursday 21st instant, which you are hereby directed to attend.

Very respectfully,

A. P. COOKE,
Captain U. S. Navy, President of Torpedo B

Commander C. F. GOODRICH, U. S. N.,
Torpedo Station, Newport, R. I.
Lieut. Commander R. B. BRADFORD, U. S. N.,
No. 19 Mann Avenue, Newport, R. I.
Lieut. A. R. COUDEN, U. S. N.,
Bureau of Ordnance, Washington, D. C.
Lieut. S. P. COMLY, U. S. N.,
League Island Navy-Yard, Philadelphia, Pa.

C 1.

NAVY-YARD, NEW YORK,
April 30, 1887.

:: I have the honor to report that the Torpedo Board will assemble at this sta- ..o-morrow, the 21st instant.

Very respectfully,

A. P. COOKE,
Captain, U. S. Navy, President of Torpedo Board.

CHIEF OF BUREAU OF ORDNANCE,
Navy Department, Washington, D. C.

H.

INSTRUCTIONS FOR THE TORPEDO BOARD.

(1) The naval appropriation bill, approved July 26, 1886, under "Increase of the ..vy," section 10, provides as follows:

"That towards the construction and completion of the vessels hereinbefore men- ..d, including the vessels and guns mentioned in section 9, the sum of $2,500,000 ..ereby appropriated, of which not more than $75,000 may be expended in manu- ..aring, purchasing, and experimenting with torpedoes of domestic manufacture ..."

(2) The Torpedo Board will be guided by the provisions of the above section (so far ..they relate to torpedoes) and by these instructions.

(3) In pursuance of the foregoing provision of the law, the Bureau published the ..lowing advertisement:

"BUREAU OF ORDNANCE, NAVY DEPARTMENT,
"*Washington, September* 8, 1887.

To whom it may concern:

"The Navy Department has appointed a board before which persons interested in ..development of torpedoes, for naval use, can exhibit their torpedoes, models, and ..ns, and perform such practical experiments as may appear advisable.

..hose who wish to avail themselves of this opportunity should communicate with ..he undersigned, who will give such further information as may be necessary in the ..ses.

"MONTGOMERY SICARD,
"*Chief of Bureau.*"

(4) For the particular inquiry to be undertaken by the Board, it will be assumed that a torpedo for naval purposes is a weapon for the attack of a vessel at or below the water-line, seeking by means of the effect of an explosive charge to admit water into the hull, and adapted to use from a vessel either of the usual kind or of special design.

(5) The objects to be examined under the above definition are as follows: Finished ..rpedoes, working models and designs (drawings or plans).

(6) The Board will not report an opinion on any object that is not complete in its ..way, *i. e.*,

(7) The finished torpedoes must be of service size and construction, with proper appliances for launching them from a vessel.

(8) Working models must be made to a convenient scale, and must represent, as nearly as practicable (in miniature), the proposed finished service weapon and its launching apparatus.

(9) Designs (drawings) must be made to a convenient scale, in full detail, and must represent exactly and clearly the manner in which all the operations of the proposed torpedo are to be performed.

(10) The person who presents the torpedo, model, or design to the Board, and who makes the explanations, guarantees, etc., is for convenience called the owner.

FINISHED TORPEDOES.

(11) When an owner submits a torpedo to the Board he will be required to describe and explain everything about the torpedo and its appendages, and it will be examined by the Board. If the Board so requires, the owner will furnish a written description of the mechanism and its action. In any event he must inform the Board in writing exactly what he claims his weapon can perform, and must also define the scope of its usefulness; that is, whether it will act efficiently under the general conditions pre-

vailing at sea or whether it is intended for use in smooth water or in special c[illegible] stances only.

(12) After full investigation the Board will decide, by vote, whether the to[illegible] shall be tried (or experimented with). In its conclusion on this point it will b[illegible] erned by the possible adaptability of the weapon to naval use, having in vi[illegible] qualities hereinbefore referred to and such others as they may think to be of i[illegible] tance, considering duly the cost of the trial to the Government as compare[illegible] the probable value of the torpedo to the Navy. If a majority of the Board shall against a trial it will not take place.

(13) Trials will be held at such times and places as the board may designat[illegible] this matter owners will be accommodated as much as a proper regard for the in[illegible] of the Government will allow.

(14) The Government will provide such a vessel and crew as it considers sui[illegible] from which the trials will be made. It will also furnish the labor for installin[illegible] working the torpedoes and their appendages, provided the cost is not exces[illegible] the opinion of the Board. Torpedoes, etc., must be delivered alongside, and also finally be removed at the expense of the owner.

(15) The vessel will furnish steam at normal pressures, if such is required for[illegible] ing the torpedo. If any other power is required it must be furnished by the o[illegible]

(16) Torpedoes (or models) and all their fittings and appendages, while bein[illegible] or experimented with, should be at all times operated by the owner.

(17) If, however, the owner desires the Board, or any members thereof, or an[illegible] son or persons in the employ of the Government, to make the experiments or tri[illegible] him, he will so request in writing. Such request must clearly and definitely r[illegible] the Government and the persons whose services are desired from all responsi[illegible] for loss or injury to the torpedo or its appendages.

(18) The Government will not, under any circumstances, be in any way respo[illegible] for the loss or injury to any torpedo or its appendages.

(19) If the owner does not desire to make or continue the trials on any parti[illegible] day, his wishes in the matter will be regarded. But he must, if so requested, p[illegible] satisfactory reasons therefor in writing to the Board.

(20) If the Board considers that other or further experiments or trials than herein laid down would be of use in determining the value of the torpedo or n[illegible] they will be undertaken if the Bureau consents after receiving from the Board [illegible] ommendation to that effect, with reasons therefor, and an estimate of the pro[illegible] cost.

(21) Among the qualities that should be possessed by a torpedo adapted to warfare, the following appear to be the most essential, and each must be re[illegible] upon:

(22) Accuracy.

(23) Certainty of operation; (*a*) certainty of launching and starting on the c[illegible] (*b*) certainty of explosive action on contact with the target.

(24) Velocity.

(25) Range.

(26) Ability to break through or avoid hostile defensive obstructions.

(27) Destructiveness.

(28) Safety in handling.

(29) Ability to keep in readiness for immediate action.

(30) Facility of manipulation.

(31) Simplicity.

(32) Ability to be operated with safety from an enemy's fire.

(33) Simplicity and efficiency of the launching apparatus.

(34) Noiselessness.

(35) The Bureau attaches very considerable importance to the qualities in para. 32 and 33; for, if there are no practical means by which the torpedo can be effic[illegible] safely, and conveniently launched in the more important directions desirable in service, this fact would detract very greatly from its usefulness; and if it c[illegible] be held conveniently in the launching position under the circumstances in w[illegible] is supposed to be used, or be readily pointed, or be sheltered properly from the an enemy (great guns and machine guns) until the vessel that carries it should within working range, it would fall far short of being an effective weapon.

(36) In connection with the qualities enumerated, the Board will note and on the following points, and any others that may appear pertinent:

(37) Is the torpedo very difficult of manufacture, and is great accuracy of facture necessary in order to obtain uniform results?

(38) Is great structural strength necessary?

(39) What effect has the motion of the vessel at sea on the preparation of t[illegible] pedo, and on the torpedo itself when in position for firing, and what effect h[illegible] motion of the vessel on facility of pointing?

(40) Is the preparation of the torpedo for action an elaborate process, and while it being handled and when in position for service are the vessel and her crew reasonably safe from injury?

(41) Is much care necessary in order to keep the torpedo in a proper state for speedy use?

Is the actuating apparatus or material reasonably safe and harmless, both when loaded and when in store, and does it probably deteriorate or dangerously change with time or with the changes of temperature and other conditions incident to service?

(43) Can the torpedo be made innocuous (automatically) at the end of the flight?

(44) Is the torpedo adapted for "exercise" practice? Is the motive power readily applied in sufficient quantity to allow frequent exercise? Is exercise expensive, and can the torpedo be recovered and practice with it be resumed speedily?

(45) Can the torpedo be conveniently and safely packed for transportation?

(46) What is the probable cost to manufacture the torpedo, with launching apparatus and other appendages complete?

(47) Although, owing to the diverse characteristics of the torpedoes that may be offered to the inspection of the Board, it is not possible for the Bureau to lay down any rigid rules for the conduct of the trial, the following programme is given as an example of what would seem to be a systematic investigation into the behavior of torpedoes on such a trial as it is the intention of the Bureau to hold, and the Board is expected to conduct its investigation in as nearly similar a manner as the circumstances of each case will warrant, the object being to bring out clearly the advantages and disadvantages of each system that is admitted to trial.

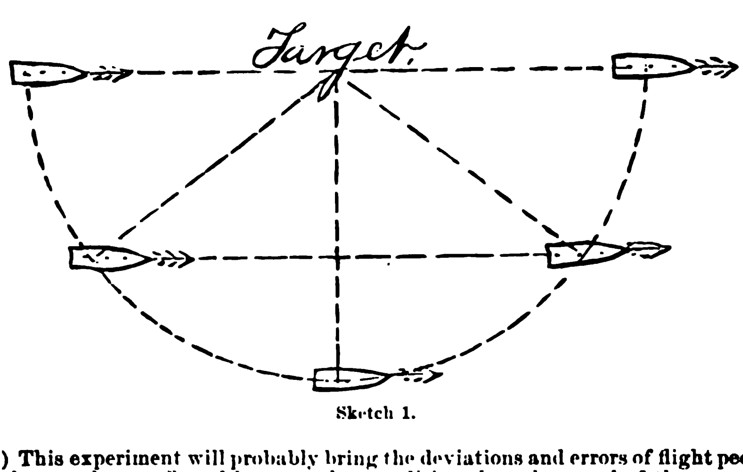
(48) After an examination of the mechanical details of the torpedoes, and the methods of carrying, loading and launching, the Board should proceed to the actual trial of those that they decide are possibly adapted to use in naval warfare, as before defined.

(49) In order that a correct idea may be formed of the character of the flight of each torpedo, and also of the distance at which practice should take place in the sea trials, some preliminary runs should be had in smooth water (against a target), either from the vessel (held in a fixed position) or from a wharf, float, or other convenient place. In this way the readiness with which each torpedo starts, its most effective range, and the time of flight to that and to shorter range, can be ascertained.

(50) A target should be employed at the longest range, and also at some of the shorter ones, and boats and range-stakes at right angles to the line of flight would be useful in marking the intervals of time on the trajectory.

(51) Having thus obtained the absolute and comparative ranges, velocity, accuracy, etc., under perfectly favorable conditions, it would appear best next to ascertain (in smooth water and without current) what deviations from the line of sight may be expected when the torpedoes are launched from a ship moving at a speed past a fixed target at a range which has been decided upon as the most effective for each torpedo.

(52) Discharges should thus be made at the target when bearing abeam, four points on the bow, four points on the quarter, and also when directly ahead and astern. It is considered that these runs are stated above in the order of their importance and of the difficulty of successful operation. (See sketch 1.)



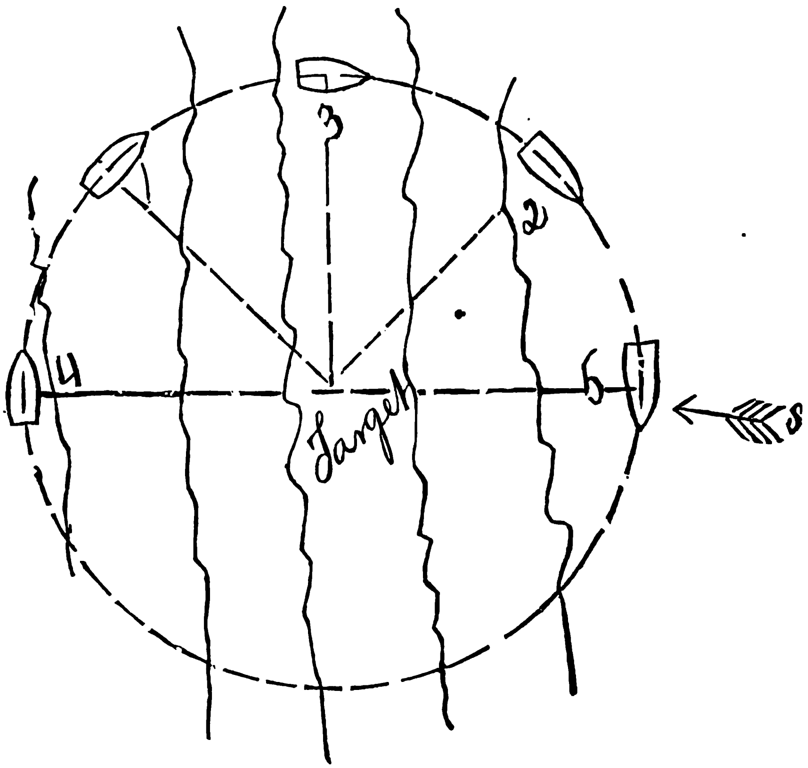
Sketch 1.

(53) This experiment will probably bring the deviations and errors of flight peculiar to each torpedo, unaffected by any other condition than the speed of the vessel. It is probable that information enough would thus be accumulated to enable the Board

to proceed in an economical and efficient manner with the regular trials at sea; these trials are the ones which are to finally determine the merits of the torpedo

(54) The next point that it appears necessary to investigate is the effect of the upon the flight of the torpedoes, and for this purpose positions should be selected which runs toward a target could be made, having the sea directly ahead, four p on the bow, abeam, four points on the quarter, and directly astern of the tor while running, the vessel and target to be both in a state of rest.

(55) Sketch 2 shows five positions that seem suitable for this experiment. are in the order of their apparent importance, and are so numbered.



Sketch 2.

(56) The effect of the sea alone on the flight being thus recorded, it remain certain the deviation due to launching the torpedoes in a seaway from the ve speed against a target at rest, the object of this part of the trial being to get direction of sea as regards the keel and the line of flight as will most clea hibit the directive force of the torpedo and operate most to throw it from the in line of flight.

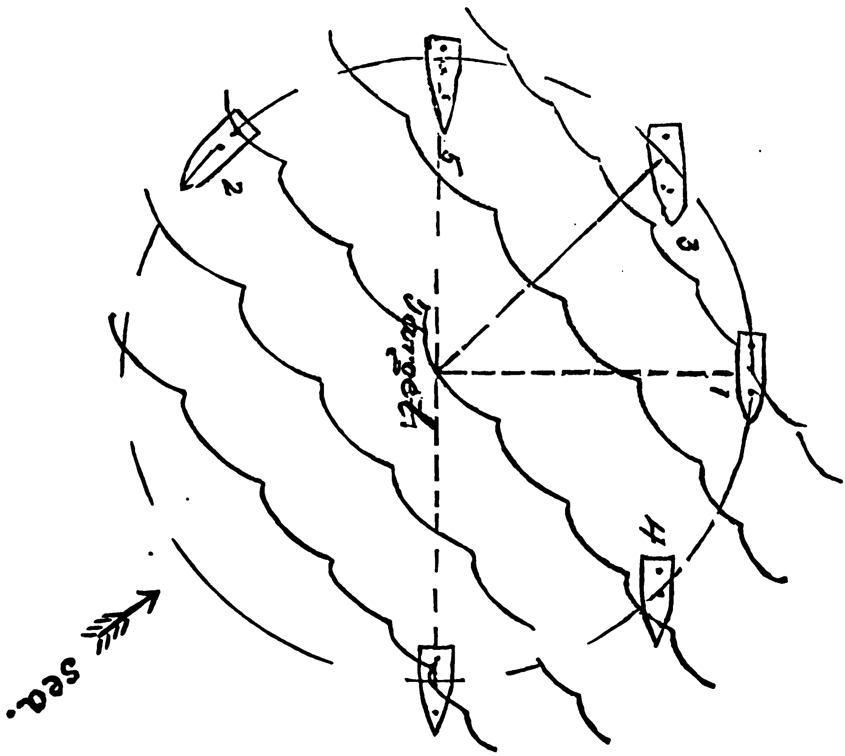
(57) Perhaps the position that would best accord with the above design wo when running a ship with the sea four points on the bow, the torpedo being la directly abeam and on the side from which the sea comes.

(58) Thus circumstanced, it appears probable that the deflective force of t running along the ship's side and the movements of the vessel herself, in roll pitching, would be about as unfavorable to accuracy as could well be obtai less running the ship directly head to sea and launching abeam should be fo unfavorable.

(59) After a sufficient number of runs have been made as above, the torpedo be launched four points on the bow and then four points on the quarter of the angle of the ship's keel with the sea remaining about four points.

(60) Sketch 3 shows the several positions above described, which are the order of their apparent importance; also two others, 5 and 6, which cult.

) There are, no doubt, other positions from which valuable data could be ob-
ued, and if any torpedo possesses any particularly distinguishing qualities (such as
-ure or speed), this fact should be made to appear (by experiment) for what it is
h.



Sketch 3.

(62) It is probable that a set of trials as nearly like the foregoing as the varying natures of the torpedoes will permit would show what value there may be in the several weapons as naval torpedoes, and, in connection with such other experiments as the Board may find it advisable to make, would afford data from which a conclusive report could be drawn.

(63) It is very important to have a convenient target, and the following is suggested as likely to answer the purpose:

A line of suitable size, with wooden or cork floats at intervals, to which should be attached a muslin or net screen (the lower edge loaded with leaden weights) hanging down some twelve feet below the surface. This could be kept stretched out in the sea trials by a boat or drag at one end. The length of the target should be about 70 feet. This need only be used for the subaqueous torpedoes. Those that run on the surface might be run at the space between two barrels made fast to a line with the same interval.

(64) Those surface (or other) torpedoes that have detachable (or falling) magazines be specially tested, in order to ascertain whether such magazines work certainly properly.

(65) It is of great importance to obtain the velocity and energy of the torpedoes at different points of the flight; and the striking energy at the working range is of essential importance, as it is a measure of the ability of the torpedo to break through defense nets, etc. This point must, if practicable, be determined by actual experiment, which may be made in smooth water if thought best. (It might be combined with the first trials.)

(66) When the runs are made from the vessel at speed, it will be necessary to observe carefully the direction of the flight, as that duty will then offer more difficulty than in the other experiments. This may perhaps be partly effected from aloft, or an

observing boat may be stationed at the point where the discharge is to take place, near the target.

(67) In the case of subaqueous torpedoes, both in smooth and rough water, every effort must be made to ascertain whether they keep a constant depth of submersion, and to value such oscillations as may occur. This can be ascertained by one or more muslin targets placed in the line of flight between the point of start and the target.

(68) The steadiness of flight must be carefully observed on all occasions.

(69) If the owner disclaims, in writing, the utility of his torpedo in a moderate sea such as frequently prevails in bays or roadsteads, and if the Board considers that it could probably be conveniently and effectively launched, directed, and used in smooth water from a vessel of not too elaborate design, the torpedo may be tried from a fixed station or from the shore, should the owner so request, and if such a course would be convenient to the Board. But in this case the report must always distinctly state that it was not tried from a vessel, and proper weight must be given to the altered conditions that such a trial would entail.

(70) If any torpedo can not be conveniently and effectively used while the vessel is in motion, that fact must always be mentioned in the report.

Models.

(See paragraph 8.)

(71) The trials of models will be carried out the same as those with torpedoes proper, so far as possible.

Designs.

(See paragraph 9.)

(72) The designs submitted to the Board must be accompanied by a detailed explanation, in writing, of all the parts and their functions, and of the action of the whole. All parts, including the launching apparatus, must be fully worked out and delineated, and the weight and volume of the whole must be stated. None of the details will be taken for granted by the Board.

(73) If the performance of a model or the character of a design is so satisfactory as to cause the Board to unanimously decide that a service torpedo constructed on the same plan would be a thoroughly effective weapon of direct and evident practical value to the Navy in war, either for general service afloat or for harbor defense, and in all essentials, for either purpose, superior to any finished weapon within its knowledge, the owner will be requested to furnish a written statement, signed by himself, setting forth distinctly and definitely the precise movements that will be performed and the results that will be obtained by his torpedo under the circumstances of wind, sea, current, etc., which he is willing to encounter. If this statement thoroughly covers the ground of general applicability, usefulness, and value as aforesaid, the Board will invite the owner to submit a formal agreement to furnish a strong and workmanlike service torpedo on the design, stating a price to be paid therefor and time of delivery. The whole record, so far as relates to the torpedo under consideration, will then be submitted to the Bureau, which will consider the expediency of making a contract for the purchase of a single torpedo for trial as aforesaid.

(74) Owners are not to be allowed to decide as to the nature of the trials (except as provided in paragraphs 18 and 70) nor as to the programme.

(75) All finished torpedoes must be presented within one year from the date of these instructions, and all persons who propose to submit torpedoes (finished weapons) must notify the Board to that effect within three months. All models and designs must be submitted within six months.

(76) The Bureau desires it to be distinctly understood that every precaution must be taken to guard effectually the vessel and all those embarked in her against injury from the torpedoes and their appliances, and the Board will be especially careful to make all reasonable preparations for safety, and to allow no person (civilian or otherwise) to expose himself to serious risk.

(77) The Board will keep a complete record of its proceedings, which will form its report. This record will be kept separately for each torpedo, model and design, and will in each case set forth clearly the conclusions and recommendations of the Board, with the reasons therefor, and will include a complete description of the object under consideration. If any member or members dissent in opinion from the report of the majority, the reasons for such dissent will be given over the proper signatures. In the reports on finished weapons that are tried to a conclusion the Board will state distinctly whether, in its opinion, they are or not adapted to naval warfare.

pedo shall be reported as being so adapted unless it has been successfully tried from a vessel, and with a proper and practical launching apparatus.

MONTGOMERY SICARD,
Chief of Bureau.

BUREAU OF ORDNANCE, NAVY DEPARTMENT,
Washington, D. C., April 4, 1887.

H.

BUREAU OF ORDNANCE, NAVY DEPARTMENT,
Washington, D. C., April 4, 1887.

SIR: You are informed that the Torpedo Board referred to in the Bureau's advertisement of September 8, 1886, is organized and has received instructions, of which inclosed is a copy.

Please inform the Board, in writing, what devices you wish to present for examination or experiment, giving a brief preliminary description of them and of their intended action.

The Board will then communicate with you regarding the examination or trial. Such papers as have been received at the Bureau have been referred to the Board. Communications intended for the Board should be addressed to Capt. A. P. Cooke, U. S. N., Navy-Yard, New York.

I am, sir, your obedient servant,

MONTGOMERY SICARD,
Chief of Bureau.

H 1.

THE HOWELL TORPEDO COMPANY,
OFFICE 39 CORCORAN BUILDING,
Washington, D. C., April 12, 1887.

SIR: This company has received from the Bureau of Ordnance a copy of instructions relating to torpedo trials, and a letter dated 4th instant, directing us to communicate with your Board. Under the head of "finished torpedoes," we beg to submit to the Board the Howell automatic steering torpedo, already briefly described in a letter presenting the same to the Bureau for trial.

We await your further instructions, and remain, respectfully,

THE HOWELL TORPEDO COMPANY,
By F. H. PAINE, *President.*

Capt A. P. COOKE, U. S. N.,
Naval Torpedo Board, Navy-Yard, New York.

H 2.

WASHINGTON, D. C., *April* 14, 1887.

SIR: As a preliminary description of the torpedo presented by us, I beg to transmit a copy of notes, hitherto collated for our own reference, and a calculation of power and speed by Gatewood.

Respectfully,

F. H. PAINE,
President Howell Torpedo Company.

Capt. A. P. COOKE, U. S. N.,
President Naval Torpedo Board.

H 3.

NOTES ON THE HOWELL TORPEDO.

General description.—The shell of the 8-foot Howell is of copper, one-twenty-fourth of an inch thick, spun to form, cigar shape, and 13.3 inches diameter. The shell may be made of homogeneous steel, a test cone of this material having been spun on the iron former. The forward end contains 70 pounds of explosive, and a percussion pin. The motive and directive power consists of a steel fly-wheel one-third the entire weight of the torpedo, geared to two shafts and twin screws. The fly-wheel is at the center of the torpedo and revolves vertically (backward) in the direction of its length.

Submergence at any desired depth is maintained by rudders actuated by water pressure and mechanism (weighing 6 pounds) placed in the after end of the torpedo. Power is stored in the wheel and sustained for any length of time before launching by the external application of steam pressure through a baker's mill, or by an auxiliary engine and gearing.

The fly-wheel is of cast steel, of tenacity to resist the centrifugal strain of 13,0 revolutions per minute. At 12,000 revolutions the developed energy is 550,000 foot-pounds; at 10,000 revolutions the energy is 373,980 foot-pounds, which is ample to give the torpedo a high speed and a practical range. The energy may be expended in a shorter or a longer time, according to the gears and propellers used.

The gyroscopic energy of the fly-wheel imparts a directive force to the torpedo which absolutely prevents any deflection from the line of fire when projected from a wave or from the broadside of a vessel moving at full speed.

Discharge tubes and launching gear.—The torpedo may be projected through a shield or may be swung down from a projected port high above the water. The tubular shield and support turn on a center to allow training in any direction. The power is conducted through this center by steam or gearing, and can be imparted to the torpedo in thirty seconds. Steam is exhausted from the baker's mill back to the condenser, making the operation noiseless. The mill clutches the fly-wheel axle until the torpedo is launched. By the action of a lever the power is shut off and the steam or compressed air admitted to two cylinders attached to the central support, projecting the torpedo through the tube.

SUMMARY OF OFFICIAL REPORTS DURING DEVELOPMENT.

In the report on a small model of this torpedo, having a 15-pound wheel, by a board of officers under date of April 14, 1883, they state that with the propellers detached and torpedo in the water, fly-wheel making 150 revolutions per second:

"On taking hold of rear end of torpedo and pulling at right angles to le[ngth it] moved parallel to itself, rolling at the same time, but no deflection could be produced."

After trials with this model, launching from the broadside under way and [with] bow of torpedo pointed down at an angle of 150, this Board reports: "From [the] trials we have witnessed and an examination of the theory of the torpedo, we are [of] opinion that it possesses a directive power of the utmost value in a broadside torpedo." And again, in technical terms: "The principle of component axes [will] prevent deflection by any force or forces whose resultant acts perpendicularly [to the] plane of the fly-wheel and in the major axis of the torpedo, and this principle [has] been successfully applied in Commander Howell's torpedo in preventing deflection [of the] torpedo in launching."

In 1884 the Torpedo Board detailed by the Secretary of the Navy, in pursuance [of] an act of Congress relative to the torpedo trials, reported of the 8-inch torpedo [as to] its directive force: "The horizontal accuracy due to the 'directive force' was [ex]cellent with the torpedo when fired from the vessel at anchor or under way [and] trained in various directions. The 'directive force' inherent in this torpedo re[nders] it unnecessary to make any allowance for the torpedoes being deflected on stri[king] the water, even when fired abeam from a vessel moving at speed."

As to launching: "The launching apparatus is simple, easy of manipulation, [and] so arranged that it can be readily protected from the fire of machine guns."

Also that the torpedo was "simple and comparatively inexpensive in construc[tion], of light weight and readily stowed and handled, and showed great accuracy [when] launched against an object." Other characteristics were not then fully determi[ned].

In 1885 the Naval Bureau of Ordnance constructed three of these torpedoes fo[r the] United States Government. Of the preliminary trials the Chief of Ordnance st[ates in] his annual report: "These trials showed that the torpedo possesses valuable q[uali]ties, chief among which is its strong directive force and its comparatively small [cost]."

Of the later trials an officer of the Bureau of Ordnance reported as to dire[ctive] force: "I see no reason to modify the report of the Torpedo Board in reference t[o the] efficiency of the 'directive force' inherent in this torpedo, directing it in th[e] course it has when it leaves the launching apparatus."

As to submergence: "During several trials the torpedo was seen for conside[rable] distances, 100 feet or more, while running under water, and in every such case i[t was] apparently on an even keel, about 4 feet (the set depth) below the surface. Th[e tor]pedo was tried in water varying in depth from 16 and 18 to 12 feet, usually abo[ut 12] feet. It had a buoyancy of 10 pounds, was set for 4 feet immersion, and was dro[pped] from a height of 5 feet 3 inches. Under such circumstances the diving apparatus [must] have acted promptly and effectively to produce the results observed." "The di[ving] apparatus consists of a diving rudder and the means of throwing it into action. [The] power of working it is taken from a propeller shaft by a worm end gear. T[his] has been explained at some length to draw attention to the small amount o[f work] done by automatic device, and the simple character of that work."

As to simplicity: "The men who handled the torpedo had never seen it be[fore;] were not specially selected, two were laboring men out of employment, and [two] were tug hands. They were entirely satisfactory and efficient. The rep[airs and] overhauling were done by men who were also entirely inexperienced as rega[rds]

pedo. They had no difficulty in doing the necessary work without any special tools pliances."

Fortifications Board reported, 1886: "This torpedo seems to fulfill the princi- requirements in a torpedo for naval purposes."

ed developed in these trials was the highest made by any torpedo of its not in proportion to the power stored in the fly-wheel; this was owing of small, improvised propellers. In the 8-foot torpedoes recently con- high speed and long range are attained by the use of well-proportioned and screw propellers.

March, 1886, a company was formed for the manufacture of these torpedoes, and April the following guaranty of performance was submitted to the present Naval retary:

1) To be of handy dimensions, so that they can be easily manipulated, and be roughly protected from machine-gun fire when awaiting launching; length, 9 t; diameter, 13.3 inches.

2) The weight not to exceed 315 pounds, and carry an explosive charge of not less n 50 pounds of gun-cotton.

3) To have a speed of not less than 19 knots for 200 yards, and a total range of not s than 400 yards.

4) To have an energy of propelling power of 340,000 foot-pounds.

5) To have an effective submergence for 300 yards.

6) To maintain, on launching from the broadside of a vessel at full speed, the di- tion in which the torpedo was pointed before launching, or, in other words, to make urate target practice under service conditions.

And on these general characteristics, which mark a torpedo adapted to naval war- the Howell Company challenged comparison or competition.

his guaranty of qualities and an offer for initial purchase were referred by the etary to the board appointed by him on additional vessels for the U. S. Navy, con- g of the chiefs of Bureaus of Navigation, Construction, and Steam-Engineer- he commandant of the Torpedo Station, Mr. Herman Winters (civilian member), fficer of the Naval Bureau of Ordnance, and two naval constructors, who, in their rsement, stated that the proposition of the Howell Torpedo Company, if carried would "give the naval service an automatic torpedo of the highest quality."

hese papers and indorsements were, on June 29, 1886, forwarded by the Secretary the Committee of Congress on Naval Affairs, with the statement that this torpedo received favorable action from a board heretofore assembled.*

he company now claims the following characteristics in the 8-foot torpedo: Length t to exceed 8 feet 6 inches. Weight not to exceed 325 pounds. Explosive charge, 70 unds. Speed, 22 knots for 200 yards; range, 800 yards. Energy or propelling wer, 375,000 foot-pounds. Directive power, absolute. Submergence, within effect- e limits.

This torpedo carries a much larger charge and has a greater speed in proportion to it than any other existing movable torpedo, and is also the simplest of construc- , preparation, and management.

The 600-pound Whitehead and Schwartzkopff carries 66 pounds of explosive, and e 880 pounds Whitehead 88 pounds. A 12-foot Howell of the latter weight would y over 300 pounds. The Sims-Edison (controlled torpedo) of 4,000 pounds weight ies 300 pounds, and has a speed of 10.4 knots. A Howell of same weight would y 1,450 pounds of explosive and have an enormous energy for propulsion.

he motive power of the Schwartzkopff and Whitehead is limited by the great ight of the air-chamber and compressed air (amounting to more than one-half the ole weight), and the engine, etc. The power of the Howell can be easily augmented y adding to the weight of wheel or increasing the revolutions. This power is definite, unaffected by leak or temperature, makes no air-bubbles, is easily calculated, and s only to be properly applied through gears and propellers; the latter, now employed the torpedo, give, with moderate power, a high speed, which can doubtless be fur- ther developed and controlled by practice, practice having been mostly limited to private means and material. The power has been thus far worked at a low limit, Gatewood's calculations being on 150 revolutions per second, whereas it can be in- creased to 200 turns.

In reference to passing under defense nets, this torpedo has withstood a pressure under way at 40 feet depth in salt water towing a buoy, and could doubtless be run below the depth of a net while towing a buoy (50 feet astern at less submersion), with grapnel hook to engage the net and discharge the torpedo. The reduced speed due to the buoy and line would not matter, as the vessel attacked would be at anchor or at low speed.

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* On February 9, 1887, the Secretary of the Navy, in reply to the Naval Committee of House, recommended a specific appropriation for Howell torpedoes.

The simplicity of mechanism is important in torpedo-boat service, as it is stated th[e] vibrations of such boats in rough water disarrange the mechanism of Whitehea[d] and that they can not be adjusted on board.

COMPARISON WITH THE WHITEHEAD AND SCHWARTZKOPFF.

The standard Whitehead is 14 feet 3 inches in length and 14 inches diameter. I[t] has an explosive charge of 66 pounds, and its market price is $2,200. The shell is [of] steel. Schwartzkopff carries the same weight of explosive and weighs 600 pound[s;] the lengths are 16 feet and 18 feet, the latter size being preferred. The mechanism [is] the same as that of the Whitehead, but all parts are made of phosphor bronze. Th[e] price of the Schwartzkopff is $2,140, an order for 100 being required. at a total cost [of] $214,400, and to acquire the right to manufacture an order for 200 must be given amounting to $428,800. To establish works for the manufacture of the Whitehea[d] or Schwartzkopff requires a large sum of money and specially instructed labor. Th[e] Howell can be made with facility from the drawings in any workshop. The smalles[t] Whitehead offered in the market, has, it is claimed, the qualities noted below. Th[e] Howell compares with it as follows:

Whitehead.		*Howell.*	
Length .... feet..	10	Length .... feet..	[illegible]
Diameter .... inches..	12	Diameter .... inches..	[illegible]
Weight .... pounds..	200	Weight .... pounds..	[illegible]
Explosive charge .... do ...	33	Explosive charge .... do ...	[illegible]
Speed for 330 yards .... knots..	20	Speed for 200 yards (range, 800 yards) knots	[illegible]
Inherent directive force, none		Inherent directive force, absolute.	
Energy of propelling force, not given.		Energy of propelling...force foot-pounds..	[illegible]

The energy for speed of the 14-foot Whitehead is less than that of the 8-foot Howell.

A Howell of the same weight as the 14-foot Whitehead (or as the Schwartzkopff) would compare as follows:

Whitehead.		*Howell.*	
Length .... feet..	14¼	Length .... feet..	[illegible]
Diameter .... inches..	14	Diameter .... inches..	[illegible]
Explosive charge .... pounds..	66	Explosive charge .... pounds..	[illegible]
Energy for speed .... foot-pounds..	350,000	Energy for speed .... foot-pounds..	[illegible]

* The present 8-foot torpedo geometrically increased.

The power of the Howell may be increased to any desired extent by using a large[r] fly-wheel, or placing a second wheel of same diameter in the torpedo, and adding t[o] the length.

EXPERT OPINIONS AND REPORTS.

[The United States Navy in Transition, Rear-Admiral Simpson, U. S. Navy, Harper's, 1886.]

"It is evident that perfection can not be associated with a weapon of this class th[at] has not a strong directive force inherent in it. The torpedo invented by Capt. J. A. Howell, U. S. Navy, possesses this property to an eminent degree, and it is regarde[d] by most competent experts as the successful rival of the Whitehead. The latest ex[-]periments of Captain Howell in controlling the emersion of his torpedo are very suc[-]cessful, and it is probable that the automobile torpedo for our new Navy will be [an] American invention. It may be estimated that millions of dollars have been sp[ent] by European naval powers in experiments with the Whitehead torpedo. The Unit[ed] States may have spent $2,500 on the Howell."

[Admiral Simpson's address to the United States Naval Institute, 1886.]

Referring to Admiral Hobart Pasha's article: "If we apply this evidence to th[e] comparative directive power of the Whitehead and the Howell torpedo, before re[-]ferred to, we will see that in the two cases cited, where, for want of directive powe[r] the Whitehead torpedo failed to accomplish any result, the Howell torpedo, poss[essing] this property to an eminent degree, would have resisted the effort to deflect it, would have achieved its object. This strikes me as very conclusive that it is a n[eces-]sary requisite for an automatic movable torpedo to have inherent in it a positiv[e di-]rective force, so as to resist efforts calculated to cause deviation. The want of th[is is] a defect which we find in the Whitehead, but we have it in the Howell torpedo as i[ts] most essential characteristic."

[General Information Series, No. 4, Bureau of Intelligence, Navy Department, 1885.]

No automatic torpedo of this size has reached such a speed, and the charge, 70 ...nds, is greater than that carried by any but the largest Whitehead."

[Recent development of naval material, Bureau of Intelligence, Navy Department, 1886.]

It is to be regretted that the Howell torpedo has not received more encourage-...t and assistance from this Government in its development.

With suitable propellers, the energy developed should give a higher speed than ... guarantied. Should the terms of that guaranty be fulfilled, it is certain that, ...ing in mind its small size and weight and performance, the Howell will be the ...t efficient torpedo yet produced for naval purposes.

The qualities of the Howell torpedo which particularly recommend it for naval ...poses are, first, its small size and weight (8 feet 11 inches by 13.3 inches; weight ...ut 300 pounds); second, its great inherent directive force, which makes it avail-...or broadside firing from vessels moving at high speeds in rough water."

[...t of Senate Committee on Ordnance and War Ships. Paper by Lieutenant-Commander Barber.]

As the Howell is at present the most promising competitor of the Whitehead, it ...uld be brought to the utmost perfection. Its principal advantages over the ...itehead are its directive force, its size, and its cost. Its remarkable power of ...ntaining the direction in which it is pointed, when acted upon by a deflecting ...e, makes it possible to launch it with accuracy from the broadside of a vessel ...le in rapid motion, which, in my opinion, is the most practicable method of using ...rpedo at sea; no other torpedo presents the advantages in this respect that are ...ssed by the Howell.

...ts size is not more than one-half that of the Whitehead, which is the most impor-... feature in regard to handiness in use and storage on board ship."

[Torpedoes for national defense, by Lieutenant Jaques, U. S. N., 1886.]

The Howell torpedo is remarkably handy, being the smallest and the lightest. It ...ies the largest charge in proportion to weight. It is not deflected in launching, ...is steered automatically, being the only torpedo having this feature. The torpedo ...mple, has few parts, and can be used experimentally with but little trouble and ...nse. Officers and men will consequently soon become expert in its use.

The most favorable positions for torpedo fire will be when ships are passing each ...r; hence, the possession of a torpedo having absolute automatic directive power ...be of inestimable value. The Howell is the only torpedo in existence enjoying ...characteristic. Its advantages of directive force, speed, size, and cost over all ...ompetitors decide its superior usefulness."

[The London Engineering, December 17, 1886, on recent English experiments.]

...n these experiments, as in most others, the Whitehead showed itself erratic with-...discovering the cause of its capriciousness, and its course was easily followed by ...on of the line of air bubbles thrown up. Owing to its want of inherent directive ...r, there is very little doubt but what the Whitehead can be readily deflected. ...l the acceptance of a type possessing this characteristic in such an absolute de-...as to permit broadside discharge from cruisers going at their highest speed, ships ...otion well-maneuvered and well-defended by quick firing guns may consider them-...s in no greater danger from torpedo attack than from gun fire."

H 4.

[...stant Naval Constructor Gatewood on comparative performance of Whitehead torpedo of 594 ...nds and Howell torpedo of 234 pounds, under similar conditions of efficiency in the expenditure ...power.]

SPEED AND POWER OF WHITEHEAD TORPEDO.

...e Whitehead is 14 feet 6 inches long, 14 inches diameter, weighs 594 pounds. Its ...d for 200 yards is 25 knots (in trial basin) with an expenditure of power, by brake ...mometer, of 133,000 foot-pounds, or at the rate of 551,260 foot-pounds per minute, ...7 horse's power (24 knots for 600 yards—360,000 foot-pounds).

... speed for 600 yards is 21.5 knots, with an expenditure of power of 255,000 foot ...ds, or at the rate of 308,482 foot pounds per minute, or 9.35 horse's power.

...e screws are 12 inches diameter, 30 inches pitch, and make 900 revolutions per ...te for the mean speed of 21.5 knots.

The performance of a 234-pound Whitehead corresponding to the 200-yard run the actual torpedo would be a mean speed of 22.11-100 knots, with an expenditure power at the rate of 233,060 foot-pounds per minute, or 7.06 horse's power.

Its dimensions would be 11 feet $4\frac{1}{10}$ inches long by 10.95 inches diameter.

SPEED AND POWER OF A HOWELL TORPEDO.

The Howell torpedo of 234 pounds weight is 9 feet long by $12\frac{1}{4}$ inches diameter, being thus somewhat bluffer than the Whitehead, but with less wetted surface.

Its fly-wheel weighs 110 pounds, has a radius of gyration of 5.4 inches, and has been run up to a speed of 150 revolutions per second, or 9,000 per minute, when energy is 306,000 foot-pounds.

If three-quarters the available energy be expended in a run of 45 seconds, the of expenditure of power will be 306,000 foot-pounds per minute, or 9.27 power.

This power should drive the Whitehead of 2,084 pounds at a speed of 23.75 so that the probable speed of the Howell on this basis should not be 1 knots.

SCREWS OF WHITEHEAD APPLIED TO HOWELL.

If screws similar to the Whitehead's were fitted to the Howell torpedo to w under similar conditions of efficiency, they would have a diameter of 10.8 in , a pitch of 27 inches, and would make 1,080 turns per minute.

A reduction of the working of the Whitehead's screws to certain standard condition shows them to be more than half again as large in diameter as the slowest running screw in screw steamers. It is probable, indeed, that screw efficiency is, in this torpedo, somewhat sacrificed to obtain a higher efficiency in the air engine operating them, and they are considered much too large for the efficient application of the power stored in the fly-wheel of the Howell torpedo.

SCREWS FOR THE HOWELL TORPEDO.

The revolutions of fly-wheel at mean power during the run of 45 seconds may be taken at 120 per second, or 7,200 per minute, which may be geared down in various ratios to suit corresponding screws.

Suitable screws, both single and twin, have been worked out for various conditions of gearing, and the resulting elements are shown by curves in the accompanying diagram. Within the limits of the curves any gearing may be adopted with a suitable diameter of screw. Certain definite ratios are shown.

Twin screws.—Screws of 5.7 inches diameter, 8.05 inches mean pitch, geared 1 to 2, to make 3,600 revolutions per minute for 600 yards, are preferred. Each should have a developed area of blades of 10 square inches, which may be in two or three blades.

Single screws.—A screw of 8.31 inches diameter, 12 inches mean pitch, geared down 1 to 3, to make 2,400 revolutions per minute for 600 yards, is preferred. It should have a developed area of blade of about 22 square inches, with two or three blades.

These screws have been dimensioned for working in open water.

If they are to work in a casing, the above diameters should be those of the casings, the diameter of the screws being less by the amount of the clearance. The pitch should then expand from the entering to the leaving edge, whereas in open water it may as well be uniform. The pitch may never be smaller at the leading edge, if casing be used, than necessary with the given number of revolutions to produce a speed of screw at entering edge of 2,330 feet per minute.

Construction of screws.—The blades are best of thin steel, formed cold with sharp edges and polished surfaces, keyed to a solid steel boss with a tail-piece.

H 5.

NAVY-YARD, NEW YORK,
April 21, 1887.

GENTLEMEN: Your letter of the 12th instant, submitting your torpedo to the Torpedo Board for examination and trial, has been received.

You are respectfully requested to furnish a written description of the mechanism of your torpedo and its action; and to inform the Board, in writing, exactly what you claim that your weapon can perform, and define the scope of its usefulness. (See paragraph 11 of instructions, second and third sentences.) Please make the two papers herein asked for distinct one from the other.

The Board will communicate further with you in regard to a time and place for the [illegible]amination and trial of your torpedo.

Very respectfully, your obedient servant,

A. P. COOKE,
Captain, U. S. Navy, and President of Torpedo Board.

The HOWELL TORPEDO COMPANY,
39 Corcoran Building, Washington, D. C.

H 6.

[illegible] OF PERFORMANCE OF THE HOWELL TORPEDO, AND SCOPE OF USEFULNESS.

[illegible] claim for it at present a greater developed power, and hence a greater speed range and a larger explosive charge, in proportion to its displacement, than is [illegible]sed by any other fish torpedo. Also a reserve of power for a still further in-[illegible] of speed when practice shall have determined the best form of propellers, and [illegible]ion of such power and speed.

[illegible] has a positive directive force in the horizontal plane and automatic steering, [illegible]cially adapting it to use from the broadside at speed, being the only torpedo not [illegible]ject to deflection on launching.

[illegible]t will act more efficiently than other torpedoes in the general conditions prevail-[illegible]at sea when projected from large vessels and torpedo boats; it is also adapted for [illegible]or defense from floating or shore batteries.

[illegible] is the simplest of construction, preparation, management, and preservation, and [illegible]target practice.

H 7.

WASHINGTON, D. C., *April* 29, 1887.

[illegible]: Your communication, dated 21st instant, was received on the 26th instant. [illegible] papers called for in pursuance of instructions, paragraph 11, are herewith in-[illegible]d.

Very respectfully,

THE HOWELL TORPEDO COMPANY.

Capt. A. P. COOKE, U. S. N.,
President of the Torpedo Board.

H 8.

DESCRIPTION OF THE MECHANISM OF THE HOWELL TORPEDO, AND ITS ACTION.

A general description of this mechanism and its action is included in *Notes on the [illegible]well Torpedo* already transmitted to the Board. The details of the same can not be [illegible]ter set forth and illustrated than in the specifications of the patents hereunto ap-[illegible]ed.

[illegible]e firing-pin, not therein described, consists of an attachment to the primer and [illegible] whereby the pin acting against a spring cocks and trips the plunger on strik-[illegible] the target. The pin is inoperative until after the torpedo is discharged, and [illegible]n at end of run.

I.

310 CHESTNUT STREET, PHILADELPHIA, PA,
April 14, 1887.

DEAR SIR: I have the honor to acknowledge the receipt of the instructions for the Torpedo Board, and will submit to the Board plans of moving torpedoes.

The plans of the torpedo invented by me in 1871 and submitted to the admiralty [illegible] on file in the Department, being a self-steering, time-firing, and plunging torpedo.

Respectfully,

BENJAMIN C. POLE.

Capt. A. P. COOKE, U. S. N.

I 1.

NAVY-YARD, NEW YORK,
April 21, 1887.

DEAR SIR: I have the honor to acknowledge the receipt of your letter of the 14th [illegible]ant in regard to your self-steering, time-firing, and plunging torpedo.

[illegible]he Torpedo Board is prepared to consider any plans you may submit coming un-[illegible] the head of its instructions of the 4th instant.

Very respectfully,

A. P. COOKE,
Captain, U. S. Navy, President of Torpedo Board.

BENJAMIN C. POLE, Esq.,
150 South Fourth street, Philadelphia, Pa.

J 1.

NAVY-YARD, NEW YORK,
April 22, 1887.

SIR: The Torpedo Board has the honor to request that orders may be given to Lieutenant Comly to proceed in search of a suitable northern locality for experiments with torpedoes, with directions to inspect places on Long Island Sound, including Oyster Bay and the vicinity of Green Point, and also in Narragansett Bay.

Very respectfully,

A. P. COOKE,
Captain, U. S. Navy, President of Torpedo Board.

CHIEF OF BUREAU OF ORDNANCE,
Navy Department, Washington, D. C.

J 2.

NAVY-YARD, NEW YORK,
April 22, 1887.

SIR: The Torpedo Board has the honor to request that authority may be given the ordnance department of this yard to make net targets for torpedoes, as follows:

Twelve nets, each 25 feet long by 12 feet wide, the nets to be made in square meshes, the verticals of light woven stuff, 12 inches apart, and the horizontals of twine 6 inches apart.

The nets to have light roping all around the four sides and to have fishermen's floats and weights at top and bottom.

Very respectfully,

A. P. COOKE,
Captain, U. S. Navy, President of Torpedo Board.

CHIEF OF BUREAU OF ORDNANCE,
Navy Department, Washington, D. C.

J 3.

NAVY-YARD, NEW YORK,
April 22, 1887.

SIR: The Torpedo Board has the honor to report its adjournment, to meet again here about the 5th of May.

Very respectfully,

A. P. COOKE,
Captain, U. S. Navy, President of Torpedo Board.

CHIEF OF BUREAU OF ORDNANCE,
Navy Department, Washington, D. C.

K.

OFFICE OF TORPEDO BOARD,
Navy-Yard, New York, April 29, 1887.

SIR: There will be a meeting of the Torpedo Board in this office on Friday next, May 6, which you are hereby directed to attend.

Very respectfully,

A. P. COOKE,
Captain U. S. N., President of Board.

Commander C. F. GOODRICH, U. S. N.,
Torpedo Station, Newport, R. I.
Lieutenant Commander R. B. BRADFORD, U. S. N.,
19 *Mann Avenue, Newport, R. I.*
Lieut. A. R. COUDEN, U. S. N.,
Bureau of Ordnance, Navy Department, Washington, D. C.
Lieut. S. P. COMLY, U. S. N.,
Navy-Yard, League Island, Philadelphia, Pa.

K 1.

OFFICE OF TORPEDO BOARD,
Navy-Yard, New York, April 29, 1887.

SIR: The Torpedo Board will assemble here on Friday next, May 6, 1887.

Very respectfully,

A. P. COOKE,
Captain U. S. N., President of Board.

CHIEF OF BUREAU OF ORDNANCE,
Navy Department, Washington, D. C.

ROYAL DANISH VICE-CONSULATE,
Washington, D. C., April 22, 1887.

GENTLEMEN: May I venture to submit to you, for the examination of your Board of a United States Patent, No. 359,491, granted to me under date of March 15,

Having, by numerous tests and experiments, both in this city and in New York, oughly tested the practicability of the primer described and explained in this nt, I am very desirous of an opportunity to demonstrate to your Board that this ot a theoretical and problematical thing, but a practical invention, especially pted as a primer for submarine torpedoes and projectiles, owing to the absolute infallible certainty with which it explodes on the slightest contact under water h the object aimed at, which it is desired to destroy.

Trusting that you will kindly give this matter such consideration as it may deserve at your hands, I am, gentlemen,

Your obedient servant,

LUIS BAGGER,
Royal Vice-Consul of Denmark, at Washington, D. C.

To the TORPEDO BOARD,
Bureau of Ordnance, Navy Department, Washington, D. C.

K 3.

Jnited States Patent Office. Louis Bagger, of Washington, District of Columbia, assignor of one-half to August Peterson, of same place. Primer for igniting exploves.]

cification forming part of letters patent No. 359,491, dated March 15, 1887. Application filed January 31, 1887. Serial No. 226,010. No model.]

all whom it may concern:

Be it known that I, LOUIS BAGGER, a citizen of the United States, and a resident of city of Washington, in the District of Columbia, have invented a certain new and ful device for igniting explosives and other combustibles; and I do hereby declare the following is a full, clear, and exact description of the invention, which will le others skilled in the art to which it appertains to make and use the same, ence being had to the accompanying drawings, which form a part of this specifi..on.

invention relates more particularly to an improved method of igniting the ex-ve charge in shells and torpedoes through the direct action of the water in which shell may drop, or in which the torpedo (whether stationary or movable) is im-rsed. It may also be used with advantage, however, in life-buoys, life-rafts, or r life-saving apparatus; for the purpose of igniting signal-lights, sounding high-er alarms, and for numerous other purposes where it is desired to ignite an ex-sive charge or other combustible material instantaneously through the direct action water; and for this purpose it makes no difference whether the water is salt or , so that my invention is equally well adapted for use on the open ocean and on ..d lakes and rivers.

.n the accompanying drawings I have shown my invention as applied to an explo-e projectile and to an anchored or stationary torpedo, viz:

Figure 1 is a longitudinal sectional view of a shell provided with my so-called ter-primer." Figs. 2, 3, and 4 illustrate some of the different methods of pro-..ng the water-primer in the shell. Fig. 5 is a sectional detail view of a fuse for lls, torpedoes, or other purposes equipped with my water-primer; and Fig. 6 is an tration of my invention as applied to a (stationary) torpedo.

..ke letters of reference denote corresponding parts in all the figures.

At the outset I will state that one of the advantages of my improvement is that it y be applied to all kinds of explosive shells, without regard to whether these are ipped with percussion-primers or with the time-fuses. In such cases, where the mary object is to explode the shell at the moment of contact with the ship or other ct aimed at, my improvement assumes the form of an auxiliary device for causing explosion of the shell if it drops into the water.

Experience with target practice with heavy ordnance has demonstrated the diffi-ty of squarely hitting a movable target, such as an iron-clad vessel or other ship ving rapidly under steam, and it frequently happens that the shell either falls a tle too short of its mark or goes a little too far beyond it, or it may drop into the ter a little ahead or astern, in either of which cases it will simply sink to the bot-without doing any damage either to the ship directly aimed at or to surrounding

Now, by providing a shell with my auxiliary fuse, or "water-primer," as I cal it, I do not in the least interfere with the prompt explosion of the shell by per sion if it does strike the vessel; but if, through failure of the percussion devic act, it should drop from the side of the ship into the water without exploding, through error of aim or from other causes, it should not hit the ship at all, but in the water, then my method and device will cause the shell to explode instar the moment it reaches the water, scattering its fragments over a large area of wa surface, and subjecting vessels at a considerable distance even to the disastrous fects of the air-wave or concussion resulting from the explosion of a charge of dy mite or other powerful explosive with which the shell may be charged on the surf of the water. If one of these shells should drop in the water in the midst of a flotill gunboats or torpedo-boats, for example, without hitting any one of them, it will stantly explode and probably prove far more destructive than if it had struc one of the boats comprising the fleet. I accomplish this object by providin shell with an auxiliary or supplemental fuse and priming the same with ma which possesses a stronger chemical affinity for oxygen than the affinity whic ists between the two components of water—viz., oxygen and hydrogen, (H_2O.) such materials several are known to chemistry, among others sodium (Na.) st tium (Sr.) and potassium (K.) The last-named metal is particularly adapted to purpose, owing to its excessive chemical affinity for oxygen, and as it is a com cial product which can readily be obtained I use it in preference to other mate This material is known in chemistry by the symbol "K," (equiv. 39, sp. gr. 0.8 and is one of the most interesting alkaline metals. It is usually obtained by th called "Brünner process," as improved by Maresca and Dormé, by the distilla of a mixture of corbonate of potassium (K_2CO_3) and charcoal at a white heat i iron retort. It floats on water, which it instantly decomposes on account of its g affinity for oxygen, with the following reaction $K_2 + 2H_2O = 2KHO + H_2$. evolved hydrogen is kindled by the heat developed by the action and burns wi violet or rose-colored flame as long as any metal remains, while the hydrate i tained in solution.

My so-called "water-primer" consists in a thin plug, disk, or film of this mat or its equivalent, as shown at A on the drawings. The letter B denotes the bod the shell, which may be of any desired shape or construction and charged with suitable explosive, and C is the usual percussion device and primer, instead of w a time-fuse may be used, if desired. The auxiliary fuse may be made by simply ing a hole through the shell, as at D, leading to the chamber E, containing th plosive material, and charging this hole with gunpowder, gun-cotton, or any c suitable explosive. In my experiments I have used quickly-burning gunpowder very satisfactory results. The hole and fuse are then plugged or covered wi thin disk or film of potassium, as shown at A, which, to protect it from oxida may be placed in a glass tube, G, open on the lower side, where it is in contact the powder in the fuse. If the shells are to be stored for any considerable leng time before using, a thin film or coating of paraffine, petroleum-paste, or similar terial containing a minimum of oxygen in its chemical composition may be ap to the under side of the disk of potassium, as indicated at H. When this is us will effectually prevent oxidation of the under side of the primer-disk, which i posed to the gunpowder in the fuse.

Instead of using the device shown in Fig. 1 for protecting the water-primer the action of the atmospheric air, other devices may be employed for the same pose, and some of these are illustrated on Figs. 2, 3, and 4 of the drawings. In 2 I have shown a plug, F, fitting air-tight in the aperture D and bearing with it ner end against the primer inserted in said aperture. When the shell is to be this plug is removed; or it may be made of material which will be fractured by explosion when the shell is fired from the cannon; or it may be of some soluble terial which will dissolve instantaneously when the shell comes in contact with water. And, again, in Fig. 3 the potassium primer is protected from atmospheric fluence by a covering in the nature of a plaster, (shown at L,) which may be moved when the shell is fired; or it may be of material which will be instantane dissolved when the shell touches water. For practical purposes, where this m is adopted for the purpose of protecting the water-primer, I have found that a of canvas treated with a composition of paraffine, rock-oil, and cement will a the purpose admirably, and will protect the water-primer for an indefinite l time. When the shell is fired, this plaster can readily be torn off, so as to exp primer to the action of the water. Again, in Fig. 4 I have shown the shell structed with a primer consisting of a complete fuse fitting into the aperture D, which it is not inserted until the moment when the shell is to be fired. Where construction is to be adopted, these fuses, primed with potassium, are kept from the shells, one being inserted in each shell as it is required.

In Fig. 4 I have indicated by dotted lines (marked with a dotted D,) how channel may be made to communicate with the percussion-primer instead of

chamber E in the body of the shell, and in Fig. 2 I have shown how the primer may be used in combination with a time-fuse by drilling a hole, D', which communicates with the time-fuse. Thus it will be seen that my device may be used in combination with a percussion-fuse or with a time-fuse, if desired, instead of using it in direct combination with the body of the shell.

When the shell is to be used, but not before, the potassium primer is exposed by breaking or removing the envelope in which it is inclosed. Should the shell drop into the water, the chemical action of the exposed primer A results in the instantaneous explosion of the shell the moment the primer touches the water through the chemical reaction hereinbefore referred to—that is to say, the primer is instantly ignited, (or, to be more exact, it ignites the hydrogen of the water which is liberated by the chemical affinity between the potassium and the oxygen of the water, or, as we have seen, $K_2 + 2H_2O = 2KHO + H_2$), the heat being more than sufficient to ignite the fuse and explode the charge within the shell even before this has been completely immersed in the water. By graduating the thickness of the primer-disk, however, the fuse may be so constructed, if desired, that explosion will not take place until the shell has been fully immersed.

In Fig. 6 I have outlined how my invention may be applied for the purpose of exploding a torpedo, the letter I denoting the body of the torpedo, and J the fuse, which may conveniently be constructed of a piece of gas-pipe filled with any suitable material adapted to be used as a fuse. The upper part, J', of the pipe or tube J, however, is made of glass or other fragile material, and inside of this is placed a suitable quantity of the water-primer. I prefer to use a glass tube, like a barometer-tube, sealed at the top and filled or partially filled with potassium, care being taken that the glass tube is connected water-tight to the metallic tube or fuse, so that water can only enter the device and ignite the potassium if the glass tube is broken or fractured. This will happen, however, when a vessel passes over it and touches the glass tube, which will then instantly be broken, thus exposing the potassium to the action of the water, when an instantaneous explosion follows. If the torpedo and fuse are made properly, so as to be impervious to water, a torpedo of this construction may be immersed any length of time without deteriorating it in the least. And, again, it is exceedingly difficult to pick up these torpedoes by means of the so-called "torpedo finders," because the least touch of a pole will break off the glass end of the fuse, and thus cause explosion of the torpedo, with the usual disastrous results.

I desire it to be understood that the foregoing illustrations of the applicability of my invention cover only a few of the very many purposes for which this is adapted. It may be used, among other purposes, on life-buoys, so that a roman-candle or signal-light will be ignited through the direct action of the water the moment the buoy is thrown into the water; or it may be used in the construction of shells filled with a suitable combustible and adapted to float on the water and primed with one of my water-primers, so that the shell will take fire when it strikes the water, and when its contents become ignited and the burning shell is floating around on the surface of the water it will serve as a light to expose the position of an enemy's vessels among which these shells are thrown. The very many purposes where my water-primer may be applied to advantage in warfare as well as in the peaceful arts will very readily suggest themselves, and do not require enumeration here.

Having thus described my invention, I claim and desire to secure by Letters Patent of the United States:

1. A primer for igniting combustible or explosive compounds, the igniting charge of which is composed of potassium or an equivalent material having a stronger chemical affinity for oxygen than the affinity which exists between oxygen and hydrogen in the formation of water whereby such primer is ignited on contact with water.

2. The combination, with an explosive shell, of a primer or igniting device composed of material possessing a stronger chemical affinity for oxygen than the affinity which exists between oxygen and hydrogen in the formation of water, whereby the shell is exploded on contact with water.

3. The combination, with an explosive shell, of a primer or igniting device composed wholly or in part of the metal known as "potassium," whereby the shell is exploded on contact with water.

4. The combination, with an explosive shell and a primer therefor having an igniting charge composed of potassium or an equivalent material having a stronger chemical affinity for oxygen than the affinity which exists between oxygen and hydrogen in the formation of water, of an air and water-proof covering for protecting such primer as set forth.

5. The combination, with a percussion primer of any desired construction, of an igniting device composed of material possessing a stronger chemical affinity for oxygen than the affinity which exists between oxygen and hydrogen in the formation of water, whereby such primer is exploded on contact of the igniting device with water.

6. The combination, with a percussion primer of any desired construction, of an ig-

niting device composed wholly or in part of the metal known as "potassium," whe[...] the primer is detonated by contact of the igniting device with water.

7. The combination, with a percussion time-fuse of any desired construction, o[...] igniting device composed of material possessing a stronger chemical affinity for [oxy]gen than the affinity which exists between oxygen and hydrogen in the formation [of] water, whereby such fuse is fired on contact of the firing device with water.

8. The combination, with a percussion time-fuse of any desired construction, [of an] igniting device composed wholly or in part of the metal known as "potassium," whereby on contact of the potassium with water the fuse is ignited, as set forth.

9. A fuse adapted to be ignited by contact with water, consisting of any suit[able] combustible material confined in whole or in part within a tube or other envelope provided with a primer or igniting device inclosed within or covered by an env[elope] of suitable material, said primer or igniting device whereby the fuse is ignited b[eing] composed of material possessing a stronger chemical affinity for oxygen than th[e af]finity which exists between oxygen and hydrogen in the formation of water.

10. A fuse adapted to be ignited by contact with water, consisting of any suit[able] combustible material confined in whole or in part within a tube or other envelope provided with a primer or igniting device inclosed within or covered by an enve[lope] of suitable material, said primer or igniting device whereby the fuse is ignited b[eing] composed wholly or in part of the metal known as "potassium."

In testimony that I claim the foregoing as my own I have hereunto affixed my [sig]nature in presence of two witnesses.

LOUIS BAGGER.

Witnesses:

ARTHUR L. MORSE,
BENNETT S. JONES.

K 4.

OFFICE OF THE TORPEDO BOARD,
Navy-Yard, New York, May 9, 1[...]

SIR: I have the honor to inform you that your letter with inclosure has been [sub]mitted to the consideration of the Torpedo Board. After examining with much i[nter]est your excellent device, I am directed by the Board to say that for the parti[cular] inquiry to be undertaken by this Board their attention is confined to weapons fo[r] attack of vessels and adapted to use from vessels. The objects to be examine[d] restricted to finished torpedoes and working models or designs of the same.

Since your device does not come within the above terms the Board regrets th[at it] does not feel itself at liberty to consider the same.

I am, sir, your obedient servant,

A. P. COOKE,
Captain, U. S. N., President of the Torpedo Bo[ard].

L. BAGGER, Esq.,
Royal Vice-Consul of Denmark, Washington, D. C.

K 5.

[First indorsement.]

BUREAU OF ORDNANCE, *April 25, 18*[...]

Respectfully returned to Torpedo Board.

The Bureau has asked the office of detail to make orders for Lieutenant Com[ly as] herein requested.

M. SICARD,
Chief of Bure[au].

The above is the Bureau's indorsement on letter of Torpedo Board, April 22, requesting that Lieutenant Comly be ordered to search for suitable locality for experiments.

K 6.

NEW YORK, *April 27, 1*[...]

SIR: In case of my ability to manipulate the dependent and consequent deta[ils] a successful performance in the air with the torpedo-car MacGilligan with [...] behalf of the public, what have you to offer towards that event?

Yours truly,

FRANK TOMPKINS.
Pr. G. A. D., 50 East Houston Street, New York C[ity].

Capt. A. P. COOKE, U. S. N.,
Navy-Yard, N. Y.

K 7.

April 28, 1887.

DEAR SIR: In answer to your letter of the 27th instant regarding the torpedo-car MacGilligan, I refer you to the inclosed circular.

Respectfully,

A. P. COOKE

Mr. FRANK TOMPKINS,
50 East Houston St., New York, N. Y.

K 8.

OFFICE OF THE TORPEDO BOARD,
Navy-Yard, New York, April 28, 1887.

SIR: For the particular inquiry to be undertaken by this Board it has been assumed that a torpedo for naval purposes is a weapon for the attack of a vessel, and adapted to use from a vessel.

The objects to be examined under this definition have been confined to finished torpedoes and working models, or designs of the same, each to be complete in its way.

In order to have your devices considered they must come within the above terms, and it will be necessary for you to inform the Board in writing what you wish to present for examination or experiment, giving a brief preliminary description of them and of their intended action.

The Board will then communicate with you regarding the examination or trial.

I am, sir, your obedient servant,

A. P. COOKE,
President of the Board

Mr. FRANK TOMPKINS,
50 East Houston Street, New York.

L.

OFFICE OF THE TORPEDO BOARD,
Navy-Yard, New York, May 7, 1887.

SIR: After fully investigating the papers, statements, and descriptions presented by the Howell Torpedo Company, in reference to the Howell torpedo, this Board has decided to experiment with that weapon.

For this purpose, the Board requests that it may have placed at its disposal a suitable vessel and crew for conducting the experiments and such labor as may be necessary for installing the torpedo.

As the motive power of this torpedo is steam at a pressure of 60 to 80 pounds per square inch, the vessel's boilers or a supplementary boiler should be capable of furnishing steam at such pressure in sufficient quantity.

Very respectfully,

A. P. COOKE,
Captain, U. S. N., President of Board.

CHIEF OF BUREAU OF ORDNANCE,
Navy Department, Washington, D. C.

M.

OFFICE OF THE TORPEDO BOARD,
Navy-Yard, New York, May 7, 1887.

SIR: The Torpedo Board has the honor to report that in accordance with its recommendation of the 22d ultimo, Lieut. S. P. Comly has visited Long Island Sound and Narragansett Bay with a view of getting the necessary information to enable the Board to decide upon suitable localities for torpedo experiments during the summer season.

The Board has selected the waters in the vicinity of Sag Harbor, Long Island, for this purpose, and proposes to have the preliminary trials in Noyack Bay, which is well protected, and later trials in Gardiner's Bay, on Long Island Sound.

Very respectfully,

A. P. COOKE,
Captain, U. S. N., President of Board.

CHIEF OF BUREAU OF ORDNANCE,
Navy Department, Washington, D. C.

N.

OFFICE OF TORPEDO BOARD.
Navy-Yard, New York, May 11, 1

DEAR SIR: Your application to have the Torpedo Board examine into the mer your invention in submarine vessels and torpedoes for naval warfare has been considered, and the Board has decided to meet at your office on the 20th insta that purpose.

Respectfully,

A. P. COOKE,
Captain, U. S. N., President of Boa

RUDOLPH M. HUNTER, Esq.,
926 *Walnut Street, Philadelphia, Pa.*

N 1.

OFFICE OF TORPEDO BOARD
Navy-Yard, New York, May 16,

SIR: There will be a meeting of the Torpedo Board in Philadelphia on Friday 20th inst., at 926 Walnut street, for the purpose of inspecting Hunter's fish torpe You are hereby directed to attend.

Very respectfully,

A. P. COOKE,
Captain, U. S. N., President of Boa

Commander C. F. GOODRICH, U. S. N.,
Newport, R. I.
Lieut. Commander R. B. BRADFORD, U. S. N.,
Newport, R. I.
Lieut. A. R. COUDEN, U. S. N.,
Bureau of Ordnance, Washington, D. C.
Lieut. S. P. COMLY, U. S. N.,
League Island, Philadelphia.
Capt. A. P. COOKE,
Navy-Yard, New York.

N 2.

OFFICE OF TORPEDO BOARD,
Navy-Yard, New York, May 16, 1

SIR: I have the honor to report that there will be a meeting of the Torpedo in Philadelphia, on the 20th instant, for the purpose of examining Hunter pedo and submarine vessel.

Very respectfully,

A. P. COOKE,
Captain, U. S. N., President of B

CHIEF OF BUREAU OF ORDNANCE,
Navy Department, Washington, D. C.

O.

WASHINGTON CITY, *May 2, 1*

Capt. A. P. COOKE, U. S. N.,
President Torpedo Board, Navy-Yard, New York:

SIR: The honorable Secretary of the Navy has directed that Mr. O'Grady have an opportunity to present the "flying pontoon" (mentioned in his let the Board on Torpedoes.

You will please examine the model, apart from the regular duties of the Bo report the facts to the Bureau.

I am, sir, your obedient servant,

M. SICAR
Chief of Bu

O 1.

OFFICE OF TORPEDO BOARD,
Navy-Yard, New York, May 3, 1

SIR: Referring to No. 1090, I have the honor to acknowledge the receipt Bureau's letter of the 2d instant, directing the Torpedo Board to examine and upon Mr. O'Grady's flying pontoon.

Very respectfully,

A. P. C E.
Captain, U. S. N., President

CHIEF OF BUREAU OF ORDNANCE,
Navy Department, Washington, D. C.

O 2.

OFFICE OF TORPEDO BOARD,
Navy-Yard, New York, May 25, 1887.

SIR: In accordance with the Bureau's order No. 1090, of May 2, there will be a meeting of the Torpedo Board at Roslyn, Long Island, on the 27th instant, for the purpose of examining the "flying pontoon" of Mr. O'Grady.

Very respectfullly,

A. P. COOKE,
Captain, U. S. N., President of Board.

CHIEF OF BUREAU OF ORDNANCE,
Navy Department, Washington, D. C.

O 3.

OFFICE OF THE TORPEDO BOARD,
Navy-Yard, New York, May 25, 1887.

SIR: There will be a meeting of the Torpedo Board at Roslyn, Long Island, on the 27th instant, for the purpose of examining Mr. O'Grady's "flying pontoon," now in the ship-yard of Thomas Clapham, at that place. You are hereby directed to attend.

Respectfully,

A. P. COOKE,
Captain, U. S. N., President of Board.

Capt. A. P. COOKE, U. S. N.,
Navy-Yard, New York.
Commander C. F. GOODRICH, U. S. N.,
Torpedo Board, Newport, R. I.
Lieut. Commander R. B. BRADFORD, U. S. N.,
No. 19 Mann Avenue, Newport, R. I.
Lieut. A. R. COUDEN, U. S. N.,
Bureau of Ordnance, Washington, D. C.
Lieut. S. P. COMLY,
League Island Navy-Yard, Pa.

P.

CATSKILL, N. Y., *May* 16, 1887.

SIR: I have the honor to present a brief description of a torpedo of my design now under construction, and to request a trial of the same at a later date.

The torpedo is of the automobile type, propelled by steam or air used in a compound engine. Its dimensions are: Length, 11 feet; diameter, 14½ inches; length of forward section, 3 feet; length of center section, 4 feet; length of after section, 4 feet; weight, 594 pounds; buoyancy, 10 pounds; diameter of high-pressure cylinder of engine, 3½ inches; diameter of low-pressure cylinder of engine, 6 inches; stroke, 6 inches; revolutions, 600 per minute; revolutions of screws, 1,800 per minute; cut-off, automatic; pressure of steam in generator, 400 pounds per square inch.

Forward section.—This section contains the charge, with firing-pin and detonator, together with a pectoral-fin on each bow. Power transmitted from the main shaft actuates these fins, which are thrown into gear by the action of a column of mercury in a bent tube. Whenever the torpedo is thrown off an even keel, either the starboard or the port fin is forced out, and, by opposing greater pressure upon that side than upon the other, rights her upon the same principle as the pressure of water under the lee bow tends to right a ship. As soon as the torpedo is righted the gearing is automatically disconnected, and a spring, assisted by the water pressure, draws the fin in again.

Central section.—This section contains the steel generator, which is packed in a non-conductor of charcoal and hermetically sealed. Within the generator is a coil of half-inch steel steam-pipe, both ends of which pass aft to the stern, where they terminate in ground slip joints to connect with pipe from superheater and discharge-pipe respectively. This coil is called the generating coil. The engine is inserted in the after end of the generator with the high-pressure cylinder inclosed therein. Steam, after passing through the engine, is condensed inside the torpedo.

After section.—This contains the immersion regulator and the engine and screw shafts and bearings. Some slight changes are to be made in the immersion regulator, after which a drawing and a detailed description of it will be furnished to the Torpedo Board.

Attached to the after end of the tail is a small vertical rudder, which is worked by a little drag consisting of a 2-inch wooden ball with a spring-reel within. The tow-line is fastened to a rod, the end of which forms a geared wheel. A pin through the center of this wheel secures the rod to the tail. This wheel gears into another wheel,

half the size, secured to the axis of the rudder. The tow-line of the drag is wound upon the above-mentioned spring-reel, and the drag stows away snugly in the end of the rudder, until forced out by the pressure of water when the torpedo is discharged. Then the tow-line is unreeled and the drag tows 5 feet astern. Being lighter than the torpedo, the drag is much more quickly acted upon by waves and currents. Where the torpedo is discharged in a sea way the drag will be immediately thrown much farther to leeward than the torpedo and will turn the balanced rudder to double the angle it makes with the longitudinal axis of the torpedo, in the opposite direction.

The joint action of the rudder and the drag brings the torpedo back to her course.

Impulse tube.—This is a light steel cylinder from which the torpedo is ejected by means of springs.

To discharge torpedo.—Place 2 quarts of water in the generator. Put torpedo in the impulse-tube and engage spring-catch with ejection-lug. Connect superheater and discharge pipes with generating coil and pass superheated steam through until the torpedo is discharged. The 2 quarts of water are speedily converted into steam of 400 pounds pressure per square inch; but owing to the volume of coil and that of generator the pressure should not rise much higher should the temperature be greater than required. To guard against accident, however, a safety-valve is provided. Discharging the torpedo automatically disconnects the steam. Compressed air can be used as a motor, if desired, but I prefer to use steam, as it avoids the necessity for cumbersome compressing machinery, and does not alter the buoyancy of the torpedo, as it is condensed within.

Upon presenting the torpedo I will furnish the Board with full drawings of and a detailed description of the same.

Very respectfully,

MARTIN E. HALL,
Lieutenant, U. S.

Capt. A. P. COOKE,
U. S. Navy.

R.

OFFICE OF THE TORPEDO BOARD,
Navy-Yard, New York, June 11.

DEAR SIR: The Board has examined with care the model, drawings, photo... and descriptions submitted by you in illustration of your system of torpedo... also your letter on the subject and the stenographic report of your statement... Board on May 6, 1887, and begs to respectfully advise you as follows:

First. No. 1 or the snubbing line system.

The Board is unable to discover that you claim anything in particular or in... this system except an automobile torpedo which you propose to be caused... under a ship's projecting net by means of an attachment between the torpedo... its carrying vessel, causing the former to describe the arc of a circle.

As an illustration of a want of definiteness on your part reference is made... statements that you may use as a motor either rocket composition or machin... latter actuated by some power which you do not mention; that you may use... chain, or rigid rod to connect the torpedo with its carrying vessel; that the... may be confined in its movements to a given plane, or remain free to move... plane; that the torpedo may be launched from a tube or cannon suspended on... points and kept in a vertical position above water or be kept suspended under... by means of a chain; that it may be launched automatically upon contact o... extending ahead of the carrying vessel, coming in contact with the target or b... that it may be launched from a cannon by a spring, as shown by the model, or b... ing a cartridge of gunpowder; that the motive power may be started by electr... by hand; that the explosion of the torpedo may be brought about upon con... mechanical means, or at will by electricity.

You have failed to submit definite scale drawings of firing apparatus, launc... detaching apparatus, and other details of your system as requested by the B...

As a copy of the instructions issued for the guidance of the Board has be... plied to you, you are no doubt familiar with its requirements. The Board, h... begs to call your attention to articles 4 to 9, inclusive, 11, 72, and 74, and to stat... is the intention of the Board to exact compliance with them.

Second. No. 2, or your system of locomotive torpedoes, employing gas from a ... composition on a turbine wheel as a motive power, sheeve wheels with friction... and levers, and fine steel wires attached to the rudder yoke for steering, and... rudders causing a towing torpedo to dive, is sufficiently shown in principle ... Board to pass upon it.

I have the honor to be, yours, very respectfully,

A. P. COOKE,
Captain, U. S. N., President of Torpedo B...

General H. BERDAN.

Q.

OFFICE OF THE TORPEDO BOARD,
Navy-Yard, New York, June 6, 1887.

SIR: I have the honor to report that there will be a meeting of the Torpedo Board at this yard on the 10th instant.

Very respectfully,

A. P. COOKE,
Captain, U. S. N., President of Board.

CHIEF OF BUREAU OF ORDNANCE,
Navy Department, Washington, D. C.

Q 1.

OFFICE OF THE TORPEDO BOARD,
Navy-Yard, New York, June 6, 1887.

SIR: There will be a meeting of the Torpedo Board at this yard on the 10th instant. You are hereby directed to attend.

Respectfully,

A. P. COOKE,
Captain, U. S. N., President of Board.

Commander C. F. GOODRICH, U. S. N.,
Torpedo Station, Newport, R. I.
Lieut. Comdr. R. B. BRADFORD, U. S. N.,
19 Mann Ave., Newport, R. I.
Lieut. A. R. COUDEN, U. S. N.,
Bureau of Ordnance, Washington, D. C.
Lieut. S. P. COMLY, U. S. N.,
League Island, Pa.

S.

NEW YORK, *June* 2, 1887.

SIR: In pursuance of circular issued by the Bureau of Ordnance of the Navy Department, dated April 4, 1887, I have the honor to address you and ask your consideration of the "controllable auto-mobile torpedo." This torpedo is constructed of copper, 36 feet long and 22 inches in diameter; it is sustained 3 feet under water by a float, also made of copper, 42 feet long and 13 inches in diameter and filled with cotton. The motor power is carbonic acid gas, and is controlled from where launched by electricity. Will go a distance of one mile, at the rate of speed of over 18 miles per hour, and will maintain its speed to the end of the course. It carries 200 pounds of explosive, which is detonated by contact or at will by electricity. It is perfectly safe in handling, can be kept in readiness for immediate action, easily manipulated, not complex.

Can be operated in safety from the enemy's fire; is launched from shore and is noiseless. This torpedo is intended for coast, harbor, and pass defenses, and will operate in any sea that is likely to occur where it is likely to be used. It can be fully charged ready for action, then launched, and by any apparatus for the purpose be attached to the side of the ship or monitor and towed to any locality desired, and then instantly detached and sent against the enemy, and can be controlled from the ship or monitor.

I have the honor to request that your Board will examine this torpedo at College Point, Long Island, at the earliest day convenient, at my cost and without any expense to the Government.

I have the honor to be, very respectfully, your obedient servant,

J. N. H. PATRICK,
Windsor Hotel, New York.

Captain COOKE,
President Torpedo Board, Brooklyn Navy-Yard.

S 1.

OFFICE OF TORPEDO BOARD,
Navy-Yard, New York, June 13, 1887.

DEAR SIR: Your communication of the 2d instant has been submitted to the Torpedo Board, and I have the honor to inform you that the Board will be pleased to examine your torpedo at College Point, as you request. It wishes to see the torpedo operated and hopes you may have facilities for conveniently accomplishing more than

one run, if it should be deemed expedient. Please notify me when you will be for the Board and then I will state when the Board can meet you.

Respectfully,

A. P. COOKE,
Captain, U. S. N., President of Board.

Mr. J. N. H. PATRICK,
Windsor Hotel, New York.

T.

OFFICE OF TORPEDO BOARD,
Navy-Yard, New York, June 18,

SIR: There will be a meeting of the Torpedo Board on the 24th instant at this station for the purpose of witnessing experiments with the Patrick torpedo at College Point.

Very respectfully,

A. P. COOKE,
Captain, U. S. N., President of Board.

CHIEF OF BUREAU OF ORDNANCE,
Navy Department.

T 1.

OFFICE OF TORPEDO BOARD,
Navy-Yard, New York, June 18, 1887.

SIR: There will be a meeting of the Torpedo Board at this station on the 24th instant, which you are hereby directed to attend.

Respectfully,

A. P. COOKE,
Captain, U. S. N., President of Board.

Commander C. F. GOODRICH, U. S. N.,
Lieutenant-Commander R. B. BRADFORD, U. S. N.
Lieut. A. R. COUDEN, U. S. N.
Lieut. S. P. COMLY, U. S. N.

T 2.

OFFICE OF TORPEDO BOARD,
Navy-Yard, New York, June 18, 1887.

DEAR SIR: Your letter of the 16th instant has been received, and I have directed the Board to assemble at this station on the 24th instant, for the purpose of witnessing experiments with your torpedo. The Board will proceed from the navy-yard to College Point in one of the yard tugs, and will probably leave the yard at about 1 o'clock or a little later.

Respectfully,

A. P. COOKE,
Captain, U. S. N., President of Board.

Mr. J. N. H. PATRICK,
Windsor Hotel, New York.

U.

PROVIDENCE, R. I., *June 14, 1887.*

SIR: We would respectfully inform the Torpedo Board that we are empowered by the inventor, Horace P. Griswold, of this city, to present for examination and experiment a working model of a torpedo-boat of novel design, and, so far as we are aware, possessing advantages and capabilities hitherto unknown in torpedo warfare.

The torpedo-boat referred to was patented to Mr. Griswold, December 22, 1885, No. 333,008, a copy of said patent being inclosed herewith.

The model now building, will be about 8 feet long, its form being cigar-shape.

In the patent drawings the boat is represented as a surface torpedo. In the new model several improvements will be added, thereby greatly increasing its efficiency.

The following description briefly points out the leading features of the invention.

It may be readily used both as a subaqueous and a surface torpedo-boat, at will.

The boat, after being launched, is wholly independent of control from without, or in other words, the several adjustments are made prior to starting on its course.

The dimensions of a full-size boat need not exceed, we think, 18 to 20 feet in length by 15 to 18 inches diameter amidships, tapering to a point at each end.

The patent explains the automatic steering mechanisms, combined with an intermittently revolving compass, electrically connected therewith. This arrangement

retained in the model, although having the releasing mechanism so arranged that the boat will take any desired angle, or angles, as predetermined and adjusted.

The motive power employed, in the model at least, is electricity, generated from a chemical battery. Storage batteries may, however, be substituted if desired.

Any deviation of the boat from its true course, due to wind, currents, tide, etc., is corrected by the compass needle which actuates a pivoted two-arm lever adapted in turn to engage mercury cups electrically connected with the mechanism.

The torpedo or explosive may be carried amidships or forward, as desired, and adapted to be fired by an electrically connected firing-pin extending through the bow of the boat.

The boat is not constructed to attain extreme velocity, but its range far exceeds any other torpedo adapted to naval warfare (excepting those whose movements are controlled by a crew on board).

No especial launching apparatus is essential, as the boat may be dropped or lowered into the sea from the side of the vessel, or it may be guided into the water by means of an inclined tube extending from the vessel.

Its destruction or injury to an enemy is limited only by the charge carried.

Means are provided by which the boat is rendered safe in handling.

All the moving parts are readily accessible, and are positive in their action, and practically noiseless; the time necessary to make the adjustment being merely normal.

The torpedo may be launched from the side of the vessel furthest from the enemy (thereby not attracting attention); after being launched the torpedo will automatically turn, according to pre-adjustment, to seek the enemy. (See sketch "A" inclosed.)

The cost of this torpedo is comparatively small, being, we estimate, about $800.

In case the torpedo does not strike the enemy, it automatically returns to the vessel or station from whence it was sent out, a device being automatically released and operated to render the torpedo safe in handling just prior to the termination of its flight.

We inclose a series of sketches showing a variety of courses which the torpedo is adapted to make.

It may be well to call especial attention to the fact that in case the torpedo fails to engage the enemy it returns to the station. After getting it on board the torpedo may be readjusted and again sent out, the torpedo returning after each unsuccessful course or run.

In conclusion, we would state that in view of the extreme novelty of this torpedo and its unusual range, combined with its greater scope and possibilities, we are confident that it will prove a very superior naval weapon.

Awaiting your action and pleasure in this matter, we remain,

Very respectfully yours,

REMINGTON & HENTHORN,
For H. P. GRISWOLD, *Inventor*,
P. O. Box 1271.

Capt. A. P. COOKE, U. S. N.
Navy-Yard, New York.

RECORD OF PROCEEDINGS OF TORPEDO BOARD FROM JULY 1, 1887, TO JUNE 30, 1888.

NAVY-YARD, NEW YORK, *July* 6, 1887.

The Board met pursuant to orders of its president (see V, V 1), all the members being present. Mr. H. Berdan and a stenographer were also present. Read and considered specifications of Berdan torpedo in connection with drawings of the same and small model to exhibit launching apparatus.

Mr. Berdan explained in detail the drawings and model. (See stenographic report.) At 12.45 Mr. Berdan withdrew. After discussion it was unanimously decided that the torpedo was not of sufficient practical value to warrant the construction of one by the Government. (See report on Berdan system of September 28, 1887.)

Read and considered letter of June 13, from Mr. Dana Dudley, with accompanying drawings. Decided to inform him that the Board would experiment with his torpedo at its earliest convenience after he reported ready for trial. (See report of October 28, 1887.)

Read letter of June 24, from Bureau of Ordnance (marked V 2) and letters to Bureau of Ordnance with indorsements of June 28 and July 1.

Discussed the Patrick torpedo and decided to draw up programme of experiments which the Board desired to make with it. To request detail drawings of torpedo, etc.

Read copy of letter by C. P. Perkins, U. S. N., to General Abbott in relation to the distance between the buoys at College Point.

Read letters to Messrs. Remington & Henthorn of June 15 and 25. (See W, W 1.)

At 3.45 the Board adjourned, subject to the call of its president.

LYNN, MASS., *July* 19, 1887.

The Board met pursuant to the orders of its president (see A A) at the house of Mr. Dana Dudley for the purpose of witnessing some experiments with the model of an air-gun designed to throw torpedoes as projectiles.

Present, all the members and Mr. Dudley.

Two models were on exhibition and a number of shots were fired from the small one and one from the large one.

The air was compressed at the moment of firing by means of the explosion of a charge of gunpowder. (See report of October 28, 1887, on Dudley's models.)

The Board adjourned subject to the call of its president.

LYCEUM, NAVY-YARD, NEW YORK,
September 5, 1887.

The Board met pursuant to order of its president. (See B B.)

Present, all the members. Read letters of July 12, 23, and August 9, from president of Howell Torpedo Company. (See V 10, 11, 12, 13, 14.)

After discussion, decided to meet at Greenport, L. I., for the purpose of entering upon the preliminary trials with the Howell torpedo. A convenient date to be decided upon in the future.

The Board then formulated its report upon the Berdan system of torpedoes.

Discussed the Patrick torpedo and decided unanimously that it should be experimented with as a weapon for coast defense.

Letter to be written to the owner requesting him to comply with paragraph 11, "Instructions to Torpedo Board," and proposing a series of experiments. Also inviting him to come before the Board to discuss the subject. (See C C and C C 1.)

The Board adjourned subject to the order of its president.

NAVY-YARD, NEW YORK,
September 28, 1887.

At 10.15 a. m. the Board met pursuant to order of its president, all the members being present. (See D D.)

The completed report of the Board upon the Berdan system of torpedoes was read and signed by all the members.

At 11.15 the Board adjourned subject to the orders of its president. (See report of this date.)

OFFICE OF THE TORPEDO BOARD,
Navy-Yard, New York, October 14, 1887.

At 10.30 a. m. the Board met pursuant to order of its president, all the members being present. (See E E.)

Read letter of October 3 from Mr. F. H. Paine presenting an aerial torpedo for special circumstance (see F F) of defense against torpedo-boats. Decided to inform Mr. Paine that the Board would consider his torpedo if it came within the scope of articles 3 and 4, instructions for Torpedo Board. (See F F 1.)

Read letter of September 9 from Lieut. B. A. Fiske, U. S. N., submitting design for torpedo. (See G G.)

Decided upon the following letter to Mr. Fiske:

"The Board has carefully considered the plan of an aerial torpedo submitted by you, with its accompanying explanation, and is of the opinion that the new features presented therein not already in possession of the Navy Department through experiments conducted by naval officers do not warrant the Board to recommend that it be constructed and experimented with at the expense of the Government.

"Should you desire to construct the proposed weapon and exhibit its qualities within the time specified in paragraph 75, torpedo instructions, the Board will, if you desire, be pleased to witness and report upon the same."

Read letter of September 29 from Lieut. M. E. Hall, U. S. N., submitting plans and description of an auto-mobile torpedo of his design.

After inspecting plans and reading description, decided to inform Mr. Hall that the Board would experiment with his torpedo. The president to write a letter requesting him to submit a programme for preliminary trials; to make a detailed statment of the facilities he expects the Government to provide and to name a day and place where it would be convenient for him to have the trials. (See H H 1.)

The Board then formulated its reports upon the Hunter Fish torpedo and Mr. Dana Dudley's buoyant torpedo and air gun.

The Board adjourned subject to the call of its president. (See report on "Hunter torpedo" October 29, 1887—and of October 28 on Dana Dudley's torpedo.)

NEW YORK NAVY-YARD,
October 27, 1887.

At 8.30 a. m. the Board met pursuant to orders of its president, all members being present. (See I I.)

The completed reports upon Mr. Dana Dudley's buoyant torpedoes and air gun, and Mr. Hunter's Fish torpedo were read and signed by the members of the Board.

A communication from Lieut. M. E. Hall, U. S. N., dated October 19, 1887, was read and considered. Decided to communicate with the Bureau of Ordnance recommending that the articles and appliances necessary to install Lieutenant Hall's torpedo be supplied as requested by him. (See J J J J 1.)

Also to write to Lieutenant Hall asking him where he wishes to have the preliminary trials take place, and where such an engine, etc., as he desires can be procured. (See J J 2, J J 3.)

At 9.30 the Board adjourned subject to the call of its president.

NAVY-YARD, NEW YORK, *November* 12, 1887.

The Board met pursuant to orders of its president. All the members present except Capt. A. P. Cooke, absent on account of sickness. (See K K.)

Read and considered Ordnance Bureau's indorsement of October 31 to letter of president of Torpedo Board dated October 28, and letters of Lieut. M. E. Hall of November 1 and November 11, also Bureau's communication of the 8th instant. (See J J 3, J J 4, K K 1.)

Decided to have preliminary trials of Hall torpedo at Newport, R. I., as soon as possible, in order to save time and expense. Letter to that effect to be written to Bureau, also a recommendation that the commandant of the torpedo station be given authority to procure the articles requested by Mr. Hall to install his torpedo. (See LL 1.) Mr. Hall to be informed of the Board's decision.

Decided to communicate with the Howell Torpedo Company requesting information as to the probable date at which the Howell torpedo will be ready for trial, and calling attention to the fact that the Board has been ready to proceed with the preliminary trials since July last, and further that the Board is of the opinion that the tests should take place with as little delay as possible. (See N N.)

At 11 a. m. the Board took a recess, and the senior and junior members proceeded to the residence of the Secretary of the Navy, W. 57th street, New York, for the purpose of furnishing him with information as to the work done by the Torpedo Board, applications laid before the Board by inventors, and action taken by the Board in each case.

At 2 p. m. the Board reconvened, all the members being present except Captain Cooke. Discussed the Patrick torpedo and decided to communicate with Mr. Patrick, reminding him that the Board was ready to proceed with further trials of his torpedo. (See O O 1, 2, 3.)

Read letter from Dana Dudley of October 30. Further action not considered necessary, as the final report upon Mr. Dudley's inventions had already been sent to the Bureau of Ordnance.

At 2.40 the Board adjourned, subject to the order of its president.

NEW YORK, N. Y., *June* 30, 1888.

At 10 a. m. Torpedo Board met, pursuant to orders of its president, all the members being present. (See P P.)

Read communciation from Mr. Dana Dudley, of Lynn, Mass., dated April 26, 1888 (see Q Q), and after discussion decided to inform him that when he is ready to exhibit an improved weapon the Board will be glad to witness any experiments he should wish to make with it.

At 11 a. m. took a recess to meet at College Point, N. Y., at 2 p. m., for the purpose of witnessing a run of a new torpedo built by Mr. Patrick for the French Government.

About 5.15 p. m. the torpedo was launched and started over the course, said to be 1 statute mile in length.

Force of wind 3 against torpedo. Very little tide with torpedo. The mile (5,280 feet) was made in 3 minutes, 4 seconds, or 28.7 feet per second, equal to 16.97 per hour.

At the end of the run the torpedo was stopped, and after cutting the electric was towed back to the starting point. The covers were then taken off and a description given of recent changes. Pressure on engine, 95 pounds. Number revolutions, about 1,590 for the mile.

All parts of the boat had been enlarged and strengthened.

The length was increased about 2 feet and the displacement was increased The principal change was in the engine. The heaters were increased to three.

A memorandum of changes will be furnished the Board by Mr. Patrick.

In addition to the Board the following persons witnessed the trial: Lieut. R. Rodgers, U. S. Navy, Lieutenant Sturdy, R. N., two Army officers from West Point, and a Japanese representative.

At 7 p. m. the Board adjourned, subject to the call of its president.

APPENDIX.

V.

JUNE 30, 18

SIR: I have the honor to report that there will be a meeting of the Torpedo Board at this station on Wednesday, the 6th of July, for the purpose of examining the model and drawings presented by General Berdan.

Very respectfully,

A. P. COOKE,
Captain, U. S. N., President of Torpedo Board.

CHIEF OF BUREAU OF ORDNANCE,
Navy Department, Washington, D. C.

V 1.

OFFICE OF THE TORPEDO BOARD,
Navy-Yard, New York, June 30, 1

SIR: There will be a meeting of the Torpedo Board at this station on Wednesday the 6th of July, for the purpose of examining the model and drawings presented General Berdan, and you are hereby directed to attend.

Respectfully,

A. P. COOKE,
Captain, U. S. N., President Torpedo Board.

Commander C. F. GOODRICH, U. S. N.,
Torpedo Station, Newport, R. I.
Lieut. Commander R. B. BRADFORD, U. S. N.,
No. 19 Mann Avenue, Newport, R. I.
Lieut. A. R. COUDEN, U. S. N.,
Bureau of Ordnance, Washington, D. C.
Lieut. S. P. COMLY, U. S. N.,
League Island Navy-Yard, Philadelphia, Pa.

V 2.

WASHINGTON CITY, *June 24, 18*

SIR: Referring to the letter of the president of the Howell Torpedo Company, dressed to you on the 16th instant and herewith returned.

Please enter into correspondence with the owner of the tug-boat, referred to longing at New Bedford and recommended as fit for the trials of the Howell torp and ascertain whether she is suitable and at what price she can be hired for t experiments, the crew of the tug-boat being its ordinary complement of officers men.

The owner should be requested to name a price per day actually employed a price per week for one or more weeks, the boat to be at the disposal of the Board ing the whole of such time. Report to the Bureau the result of the inquiry fo decision.

It is proposed, if reasonable terms can be made with the owner of the tug-boa use her in all the preliminary trials for speed, accuracy, and range where the might be unsuitable on account of her draught.

It is understood that the *Dolphin* will be placed at the disposition of the Board ing all the trials, and will furnish the necessary boats and assistance not pro

tug, and she will be used for the running and outside trials and all other than ... indicated above. The detaching or launching apparatus can be fitted to the ...phin (for trials from that vessel) in such a position and with suitable staging, etc., ...ound necessary or desirable, that the torpedo shall have no greater drop than is ...dered by the owner as suitable and proper.

... re seems to be any anxiety on the part of the owner as to the effect of the sea the apparatus so fitted, the Board will be expected to exercise a sound and proper ...etion to avoid evident injury or loss of the torpedo or apparatus due directly to ...use of the *Dolphin* in lieu of a vessel with lower free-board.

...s there is considerable expense connected with these trials, they should be as ...rough and exhaustive as possible, and the owner should be allowed every reasona... opportunity to show the capabilities of the weapon he presents.

I... ase communicate the substance of the foregoing to the owner of the Howell tor...o for such remarks as he may wish to make.

I am, sir, your obedient servant,

M. SICARD,
Chief of Bureau.

Capt. A. P. COOKE,
President Torpedo Board, Navy-Yard, New York.

COMMANDANT'S OFFICE,
Navy-Yard, New York.

Forwarded June 27, 1887.

BANCROFT GHERARDI,
Commodore, Commandant.

V 3.

WASHINGTON, D. C., *June* 16, 1887.

DEAR CAPTAIN: I have received your note of yesterday in reference to the *Dolphin*. I would like very much to commence the trials soon, but will give my reasons and impressions against the use of the *Dolphin* or other large vessel for the first trials. The principal reason is the difficulty of taking such vessel into the shallow and protected positions best suited for the speed, range, and submergence trials, and holding her there in a fixed position at the end of the buoyed range. Also this launching apparatus is not made for the *Dolphin's* height of deck and would necessitate a staging outside to bring the torpedo down to the usual height (or even greater height) of a ship's discharge tube. In sea trials this staging would be likely to be much more untenable, by reason of the swash of waves along the side, than the deck of a tug or torpedo boat.

Our torpedo is as well adapted to be discharged from a tube as is a Whitehead, but as yet none of our vessels are fitted with tubes and ports for the purpose; and as the present launching apparatus was reported on by the former Board as "simple and good—admits of rapid and easy training," and will demonstrate the ability to launch the torpedo and show the qualities thereof, we presented it as it stands for the trials. It is readily protected from machine-gun fire and well adapted for torpedo-boat service and, with some modification and proper parts, for larger vessels. Should the Government hereafter desire special forms of discharge apparatus for the different types of vessels, they can be furnished and have any means of acceleration and height of discharge suited to the varying circumstances. But I submit that we should not now be expected to furnish more than one *efficient* means.

From my experience in testing the torpedo, I would respectfully suggest that the best way to begin the trials—in view of our Government having no torpedo vessels or convenient vessels with modern boiler (steam) pressure—would be to charter the New Bedford tug for the (near-shore) speed and regularity of direction tests, and after July 1 to fit the *Stiletto* for broadside discharge at speed, and other trials; meanwhile having the *Stiletto's* boiler tested with 1½-inch opening, steam to decrease from not over 100 pounds pressure to not under 60 pounds pressure in one minute. And should the *Stiletto's* boiler be too small, then to continue operations with the tug (which was made for a sea-going fishing steamer). I have no doubt the qualities of the torpedo can be thus determined before going to the expense of cutting and fitting a large vessel.

I think some compromise of opinion, if any exists, should be effective, in view of the fact that our Government has no artificial trial basin for the finer tests, as used abroad, and no torpedo boats, or modern small vessels, or large vessels with suitable ports, etc., for the purpose of open water trials.

Some allowance and opportunity should, I think, be accorded to us on that account.

It seems to me as economical to charter a cheap tug as to fit a navy tug . . boiler; and a navy tug could be used as a tender and base of supplies (for the . . and transportation to nearest town or railway connection.

Commending myself and the torpedo to your kind consideration in this matter:

Very truly, yours,

F. H. PAINE.

Captain COOK,
U. S. Navy.

V 4.

JUNE 2-, 18—

DEAR SIR: Will you please let me know if you have a tug-boat suitable for experiments with the Howell torpedo? It is proposed, if reasonable terms can be made, to use such a tug in the waters at the eastern end of Long Island for the purpose of making certain preliminary trials to ascertain the speed, accuracy, and range of the weapon.

Another vessel will be present during the trials and will furnish the necessary boats and assistance not provided by the tug.

I am informed by Mr. F. H. Paine, president of the Howell Torpedo Company, that you have a tug fit for these trials.

At what price can she be hired for these experiments, the crew of the tug being the ordinary complement of officers and men? You will please name a price per day actually employed, and a price per week for one or more weeks, the boat to be at the disposal of the Board making experiments, during the whole of this time.

Respectfully,

A. P. COOKE,
Captain, U. S. Navy, President of Board.

HART & AIKEN,
New Bedford, Mass.

V 5.

JUNE 28, 18—

F. H. PAINE, Esq.,
President of Howell Torpedo Company,
30 Corcoran Building, Washington, D. C.:

DEAR SIR: Referring to your letter of the 15th instant, I have to say that I am directed by the Navy Department to enter into correspondence with the owner of the tug-boat referred to, and recommended as fit for the trials of the Howell Torpedo, with a view to hiring her for these experiments.

It is proposed, if reasonable terms can be made with the owner of the tug-boat, to use her in all the preliminary trials for speed, accuracy, and range where the *Dolphin* would be unsuitable on account of her draught.

It is understood that the *Dolphin* will be placed at the disposal of the Board, during all the trials, and will furnish the necessary boats and assistance not provided by the tug, and she will be used for the running and outside trials, and all others than those indicated above.

The detaching or launching apparatus can be fitted to the *Dolphin* (for trials from that vessel) in such a position, and with suitable staging, etc., if found necessary or desirable, that the torpedo shall have no greater drop than is considered by the owner as suitable and proper.

If there should at any time be anxiety on the part of the owner as to the effect of the sea on the apparatus so fitted, the Torpedo Board will exercise discretion to avoid evident injury to the torpedo or apparatus, due directly to the use of the *Dolphin* in lieu of a vessel of a lower free-board.

Very respectfully,

A. P. COOKE,
Captain, U. S. Navy, President of Torpedo Board.

V 6.

NAVY-YARD, NEW YORK,
July 2-, 18—

DEAR SIR: Referring to my letter of the 13th instant, I understand your tug has a pulling boat with a crew of two men.

Will you please add to your estimate, in a separate statement, the amount for which you will furnish an additional boat and crew of two men, in case it should be deemed necessary.

Awaiting an answer to my letters, I am, yours truly,

A. P. COOKE,
Captain, U. S. Navy, President of Torpedo Board.

Capt. THOMAS A. SCOTT,
Pequot avenue, New London, Conn.

[First indorsement.]

BUREAU OF ORDNANCE, *July 27*, 1887.

Respectfully returned to Torpedo Board.

Such assistance as the Board considers necessary can be employed under the 14th paragraph of the "Instructions for the Torpedo Board," but only for installing and working on board of the vessel selected for the trials of such torpedo apparatus as the torpedo company presents as practical forms of service type and that which they intend to use in the trial without material alteration.

No part of the appropriation is to be used by the company for developing their torpedo or launching apparatus.

M. SICARD,
Chief of Bureau.

The above is the Bureau's indorsement on the letter from the Torpedo Board, dated July 26 (V. 7), in reference to the employment of a machinist and an assistant for installing the Howell torpedo, etc.

V 7.

JULY 26, 1887.

SIR: Referring to paragraph 14 of the instructions for the Torpedo Board, which states that labor will be provided for the installing and working of the torpedoes and their appendages, provided the cost is not excessive, the President of the Howell Torpedo Company has requested that he may employ, at Government expense, for carrying on his experiments, one machinist at $3.50 per day and one assistant at $2.50 per day, the men to be selected.

I have the honor to submit this request to the Bureau.

Very respectfully,

A. P. COOKE,
Captain, U. S. Navy, President of Torpedo Board.

CHIEF OF BUREAU OF ORDNANCE,
Navy Department, Washington, D. C.

V 8.

JULY 27, 1887.

SIR: Referring to the Bureau's letter No. 1170, of the 24th of June, I have the honor to state that I have received the following proposition from T. A. Scott, a tug owner and wrecker of New London, Conn. He proposes to furnish the tug *Thomas A. Scott, Jr.*, for the purpose of the trials with the Howell torpedo in the vicinity of Sag Harbor, Long Island, at the following rates: $30 per day (no half day,) or $160 per week, including the use of a yawl boat with a crew of two men.

He will also furnish an additional small boat and crew of 2 men for the sum of $5 per day, or $27 per week. The crew of the tug will assist in hooking on the torpedo, etc., when not otherwise employed.

This tug has been pronounced by the president of the Howell Company as entirely suitable for the work proposed, and the additional small boat and crew will furnish all the facilities necessary for the preliminary trials for speed, accuracy, and range of the torpedo without the assistance of any other vessel.

Very respectfully,

A. P. COOKE,
Captain, U. S. Navy, President of Torpedo Board.

CHIEF OF BUREAU OF ORDNANCE,
Navy Department, Washington, D. C.

V 81.

NEW LONDON, CONN., *July 25*, 1887.

SIR: In reply to your communication asking my terms by the day and by the week for the tug *Thos. A. Scott, Jr.*, for the purpose of torpedo trials in the vicinity of Sag Harbor, Long Island, I would state that the terms are $30 per day (no half day), or $160 per week, including the use of a yawl boat with crew of two men. I can furnish an additional small boat and crew of two men for the sum of $5 per day or $27 per week. The crew of the tug will assist in hooking on the torpedo, etc., when not otherwise employed on board.

Meals can be furnished to machinists and others at 25 cents each.

Respectfully yours,

T. A. SCOTT.

Capt. A. P. COOKE,
President of the Naval Torpedo Board.

V 9.

JULY 30, 1

DEAR SIR: Will you please inform me how long you think you will requi proposed tug and boats to demonstrate before the Board the capabilities of yo pedo.

As there will be considerable expense connected with the trials they shoul thorough and exhaustive as possible.

Very respectfully,

A. P. COOKE,
Captain, U. S. Navy, President of Torpedo B

F. H. PAINE, Esq.,
39 Corcoran Building, Washington D. C.

V 10.

NEW LONDON, *July* 12,

DEAR SIR: I have inspected the tug *Thos. A. Scott, Jr.*, owned by Capt. Th Scott, Pequot avenue, New London, and find that it is well suited to the p trials. The boiler is larger than that of the *Hunt*, at New Bedford, and the p 85 pounds. Connection can be made to the top of the steam drum and the ste ducted to the port quarter, where there is a good space for hooking on and lau the torpedo.

For work at Sag Harbor and vicinity Captain Scott charges $30 a day whe ally employed, or $15 for half a day should the tug be returned to New Lo taken from New London at midday instead of morning or evening. Should w off work for a day or so, Captain Scott says he would probably wait at Sag for the continuance of trials, not actually employed meanwhile, of course. In to terms by the week, subject to a call, he does not exactly understand what is w but thinks that to hold in readiness for a call any day there should be adde payment for time actually employed 25 per cent. That is, if you use the tug te ing days, it would be $ 00 + $75 = $375. Whatever you consider proper for p in view of holding the said tug always ready at short notice I think he will a He appears to be anxious to accommodate in every way and to make fair te half days, detentions, etc. For the terms stated, he will have an extra hand a and a boat with two men. He furnishes meals to extra hands at 25 cents eac

He has a workshop, and the necessary valves and 3-inch connections, and ready any day. They are wreckers and accustomed to all sorts of weath work.

The cabin has a table for lunch or writing.

I return to Pomfret to-day, and will await your directions to prepare for tri

Yours, hastily and respectfully,

F. H PAINE
(for the Howell Torpedo Comp

Capt. A. P. COOKE.

V 11.

WASHINGTON, D. C., *July* 23,

SIR: I beg to acknowledge the receipt of your communications of the 2-th and 11th instant. In reference to a tug for trials of the Howell torpedo, the *A. Scott, Jr.*, of New London, appears to be well adapted for the purpose, and l pulling boat with a crew of two men. If an additional small boat and crew to be furnished from a naval tug or tender, I would suggest that the item of a boat and crew of two men be added to the contract for the *Scott* or such tug Board may charter.

Referring to paragraph 14 of the instructions, which state that "It (the G ment) will also furnish the labor for installing and working the topedoes an appendages, provided the cost is not excessive, in the opinion of the Board," we like to employ a machinist at $3.50 per day, and assistant at $2.50 per day. W suitable men in mind for the purpose.

Respectfully,

F. H. PAINE,
President Howell Torpedo Com

Capt. A. P. COOKE, U. S. N.,
President of the Torpedo Board.

V 12.

WASHINGTON, D. C., *August* 9,

SIR: I beg to acknowledge the receipt of your communication, forwar Washington, asking me to inform you how long I think we will require the tug and boats to demonstrate before the Board the capabilities of our torpe

As the wind and weather may delay the trial for determining speed and submergence on the measured range, it is impossible to estimate the time accurately, but I should think that fifteen actual working days, more or less, would suffice to make the desired trials.

Very respectfully,

F. H. PAINE,
President Howell Torpedo Company.

Capt. A. P. COOKE,
President Torpedo Board.

V 13.

NAVY-YARD, NEW YORK.
August 13, 1887.

SIR: Proceed to New London, Conn., for the purpose of examining the tug *Thos. A. Scott, Jr.*, which has been offered to the Torpedo Board for experiments with the Howell torpedo by Mr. T. A. Scott, a tug owner and wrecker of that place.

If the vessel is suitable for the purpose, you will hire her for such time and upon h terms and conditions as will be furnished you by the president of the Torpedo ard.

Then return to your station.

Very respectfully,

A. P. COOKE,
Captain, U. S. N., President of Torpedo Board.

Lieut. S. P. COMLY, U. S. N.,
U. S. Navy-Yard, League Island, Philadelphia, Pa.

V 14.

NAVY-YARD, NEW YORK,
August 24, 1887.

DEAR SIR: The Torpedo Board has engaged the tug-boat *Thos. A. Scott, Jr.*, of New London, Conn., for the purpose of making trials with the Howell torpedo in the vicinity of Sag Harbor, L. I.

In accordance with your suggestion it has secured the boat for two weeks, if that length of time should prove necessary.

If agreeable to you I will give directions to have the tug meet the Torpedo Board at Sag Harbor on Tuesday, September 6, to begin the trials.

Yours truly,

A. P. COOKE,
Captain, U. S N., President Torpedo Board.

F. H. PAINE, Esq.,
President Howell Torpedo Company, 39 *Corcoran Building, Washington, D. C.*

[The Bureau's indorsement on letter from the Torpedo Board of July 27, 1887 (V. 8), in relation to the hire of the tug-boat *Thomas A. Scott, Jr.*, for experiments with the Howell torpedo.]

[First indorsement.]

BUREAU OF ORDNANCE, *July* 29, 1887.

Respectfully returned to the Torpedo Board. From the tenor of your letter, the Bureau concludes that you do not desire the presence of the *Dolphin* at the preliminary trials of the Howell torpedo. Please inform the Bureau how long you think you will require the tug, with the additional small boat and crew.

M. SICARD.

[Second indorsement.]

NAVY-YARD, NEW YORK, *August* 11, 1887.

Respectfully returned to the Bureau. As wind and weather may delay the necessary trials somewhat, it is impossible to estimate the time accurately, but probably two weeks, more or less, will suffice. The presence of the *Dolphin* is not deemed essential at these preliminary trials.

A. P. COOKE,
Captain, U. S. N., President of Torpedo Board.

[Third indorsement.]

BUREAU OF ORDNANCE, *August* 12, 1887.

Respectfully returned to the Torpedo Board. The Bureau authorizes the use of the tug with small boat and crew of two men, for two weeks, at the rates specified,

and hopes that the test of the Howell torpedo, for which this service is required, can be completed within the time named. It is understood that the yawl with two men are to be included.

M. SICARD.
Chief of Bureau.

W.

PROVIDENCE, R. I., *June* 14, 1887.

SIR: Referring to the circular of "Instructions for the Torpedo Board," recently issued by the Bureau of Ordnance, of the Navy Department, we would respectfully inquire what is the usual size of the "netting wire" and "mesh" used to protect vessels from torpedoes?

Very respectfully, yours,

REMINGTON & HENTHORN.

Capt. A. P. COOKE, U. S. N.,
Navy-Yard, New York.

W 1.

OFFICE OF THE TORPEDO BOARD,
Navy-Yard, New York, June 24, 1887.

GENTLEMEN: In answer to your letter of the 14th instant, requesting information in reference to the usual size of the netting wire and mesh used to protect vessels from torpedoes, I would state that there is no standard size in use in our service, but the following has been proposed: a net made of 6-inch grommets, using steel wire rope ⅜ inch in diameter joined laterally and vertically, by open links 2¼ inches long and ⅜ inch in thickness.

The net used by the English in 1886 consisted of grommets 6¼ inches in diameter, of wire rope ½-inch in diameter. These grommets were held together by means of links of 1⅜ inch in diameter and ⅜ inch in thickness.

Respectfully,

A. P. COOKE,
Captain, U. S. N., President of Torpedo Board.

Messrs. REMINGTON & HENTHORN,
Providence R. I.

A A.

JULY 12, 1887.

SIR: There will be a meeting of the Torpedo Board at Lynn, Mass., on the 19th instant, for the purpose of witnessing experiments with a torpedo invented by Mr. Dana Dudley of that place.

You are hereby ordered to be present.

Respectfully,

A. P. COOKE,
Captain, U. S. N., President of Torpedo Board.

Commander CASPER F. GOODRICH, U. S. N.
Torpedo Station, Newport, R. I.

JULY 12, 1887.

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You are hereby ordered to be present.

Respectfully,

A. P. COOKE,
Captain, U. S. N., President of Torpedo Board.

Lieutenant-Commander R. B. BRADFORD, U. S. N.,
No. 19 Mann Ave., Newport, R. I.

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A. P. COOKE,
Captain, U. S. N., President of Torpedo Board.

Lieut. A. R. COUDEN, U. S. N.,
Bureau of Ordnance, Washington, D. C.

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Respectfully,

A. P. COOKE,
Captain, U. S. N., President of Torpedo Board.

Lieut. S. P. COMLY, U. S. N.,
League Island Navy-Yard, Philadelphia, Pa.

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You are hereby ordered to be present.

Respectfully,

A. P. COOKE,
Captain, U. S. N., President of Torpedo Board.

Capt. A. P. COOKE, U. S. N.,
Navy-Yard, New York.

JULY 12, 1887.

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Very respectfully,

A. P. COOKE,
Captain, U. S. N., President of Torpedo Board.

CHIEF OF BUREAU OF ORDNANCE,
Navy Department, Washington, D. C.

JULY 12, 1887.

DEAR SIR: I have the honor to acknowledge the receipt of your letter of 11th instant. The Board will be at the Central Depot in Lynn on or about 10 a. m., according to the arrival of the trains, and desire to meet you at the depot.

Respectfully,

A. P. COOKE,
Captain, U. S. N., President of Torpedo Board.

DANA DUDLEY, Esq.,
No. 77 Maple street, Lynn, Mass.

B B.

OFFICE OF THE TORPEDO BOARD,
Navy-Yard, New York, August 31, 1887.

There will be a meeting of the Torpedo Board at this station on the 5th of September and you are hereby directed to attend.

Respectfully,

A. P. COOKE,
Captain U. S. N., President Torpedo Board.

Commander C. F. GOODRICH, U. S. N.,
Torpedo Station Newport, R. I.
Lieutenant-Commander R. B. BRADFORD, U. S. N.,
19 *Main Avenue, Newport, R. I.*
Lieut. A. R. COUDEN, U. S. N.,
Bureau Ordnance, Washington, D. C.
Lieut. S. P. COMLY, U. S. N.,
League Island Navy-Yard, Philadelphia, Pa.

C C.

NAVY-YARD, NEW YORK,
September 5, 1887.

DEAR SIR: During the absence of Mr. Patrick from the country he wished me to communicate with you regarding all matters connected with his torpedo.

The Torpedo Board has decided to draw off a programme of experiments which I would like to have carried out with your weapon when perfectly convenient. Meantime I have to request that the Board may be furnished with a drawing of the Patrick torpedo longitudinal section, on a scale of one-eighth inch or one-fourth inch to 1 foot.

Very respectfully,

A. P. COOKE.

GEO. E. HOIGHT, Esq.,
205 *Whaley avenue, New Haven, Conn.*

C C 2.

OFFICE OF THE TORPEDO BOARD,
Navy-Yard, New York, September 28, 1887.

DEAR SIR: The Torpedo Board has decided to experiment with your torpedo whenever it may be perfectly convenient to you, and has to suggest the following trials, with a view of issuing it as a coast defense weapon only.

(1) You will be called upon to comply with paragraph 2, instructions to the Torpedo Board, describing and explaining your torpedo; also how you propose to launch it in service.

(2) A trial will be made with a view to determine the extra speed caused by the use of boilers, also another trial similar to the one already witnessed, except that no chemicals for generating heat shall be carried or used.

(3) A trial to determine the behavior while maneuvering, and particularly when stopped for some time with boilers in operation; also a trial similar to the one already witnessed, the starting, stopping, and steering to be under the control of the Board.

(4) A night trial against a ship at anchor (the magazine not to be charged), the ship to be protected by nets.

(5) A trial against a moving ship while passing through a narrow channel (the magazine not to be charged), channel between Fort Schuyler and Willet's Point suggested.

(6) A trial to determine the velocity and energy of the torpedo at different points of the flight (see paragraph 65, Instructions to Board; also paragraph 25).

In all the trials the firing mechanism to be connected up, a fuze or harmless cartridge to take the place of the magazine charge, and its behavior noted. Fuze or cartridge to be so arranged, if possible, that in case it exploded it would be seen. Also such trials as may be necessary to determine the working of the firing apparatus.

Respectfully,

A. P. COOKE,
Captain, U. S. N., President Torpedo Board.

GEO. E. HAIGHT, Esq.,
205 Whaley Avenue, New Haven.

D D.

NAVY-YARD, NEW YORK,
Office of the Torpedo Board, September 24, 1887.

SIR: There will be a meeting of the Torpedo Board at this office on the 28th instant, and you are hereby directed to attend.

Respectfully,

A. P. COOKE,
Captain, U. S. N., President Torpedo Board.

Commander C. F. GOODRICH, U. S. N.,
Torpedo Station, Newport, R. I.
Lieutenant-Commander R. B. BRADFORD, U. S. N.,
19 Mann Avenue, Newport, R. I.
Lieut. A. R. COUDEN, U. S. N.,
Bureau of Ordnance, Washington, D. C.
Lieut. S. P. COMLY, U. S. N.,
League Island Navy-Yard, Philadelphia.

E E.

OCTOBER 6, 1887.

SIR: There will be a meeting of the Torpedo Board at this station on Friday, the 14th instant, which you are hereby directed to attend.

Respectfully,

A. P. COOKE,
Captain, U. S. N., President of the Torpedo Board.

Lieut. S. P. COMLY, U. S. N.,
League Island Navy-Yard, Philadelphia, Pa.

OCTOBER 6, 1887.

SIR: I have the honor to report that there will be a meeting of the Torpedo Board at this station on Friday, the 14th instant.

Very respectfully,

A. P. COOKE,
Captain, U. S. N., President of Torpedo Board.

Chief of BUREAU OF ORDNANCE, NAVY DEPARTMENT,
Washington, D. C.

OCTOBER 6, 1887.

: There will be a meeting of the Torpedo Board at this station on Friday, the instant, which you are hereby directed to attend.

Respectfully,

A. P. COOKE,
Captain, U. S. N.; President of Torpedo Board.

Lieut. A. R. COUDEN, U. S. N.,
Bureau of Ordnance, Navy Department, Washington, D. C.

OCTOBER 6, 1887.

: There will be a meeting of the Torpedo Board at this station on Friday, the instant, which you are hereby directed to attend.

Respectfully,

A. P. COOKE,
Captain, U. S. N., President of the Torpedo Board.

Commander C. F. GOODRICH, U. S. N.,
Torpedo Station, Newport, R. I.

OCTOBER 6, 1887.

SIR: There will be a meeting of the Torpedo Board at this station on Friday, the 14th instant, which you are hereby directed to attend.

Respectfully,

A. P. COOKE,
Captain, U. S. N., President of the Torpedo Board.

Lieutenant-Commander R. B. BRADFORD, U. S. N.,
19 *Mann Avenue, Newport, R. I.*

F F.

39 CORCORAN BUILDING, WASHINGTON, D. C.,
October 3, 1887.

SIR: Referring to the published "Instructions for the Torpedo Board" in the matter submitting finished torpedoes, models, and designs, and of informing the Board of ims of usefulness of any particular weapon, or of "special circumstances" only, I to submit to the Board my aerial torpedo for the special circumstance of defense inst torpedo boats or controlled or submarine boats; and to reserve the submission detailed designs or a finished model (at my own expense) until instructed by you to whether the Board is willing to consider the question of aerial torpedoes for the special purpose aforesaid, and if so, whether in the form of detailed designs or a working model at my expense.

Very respectfully,

F. H. PAINE.

Capt. A. P. COOKE, U. S. N.,
President of Torpedo Board.

F F 1.

October 15, 1887.

DEAR SIR: In acknowledging the receipt of your communication of the 3d instant, the Board has to say that it will consider your torpedo therein referred to provided it comes within the scope of articles 3 and 4 of "Instructions for the Torpedo Board."

Very respectfully,

A. P. COOKE,
Captain, U. S. N., President of Torpedo Board.

F. H. PAINE, Esq.,
President of the Howell Torpedo Company,
39 *Corcoran Building, Washington, D. C.*

H H 1.

OCTOBER 15, 1887.

SIR: The Torpedo Board, after a careful consideration of the plans and descriptions of your torpedo, have decided to experiment with the same, and request that you will submit a programme for the preliminary trials; that you make a detailed statement of the facilities you expect the Government to provide, and also that you name date and place when and where it will be convenient for you to have the trials.

Very respectfully,

A. P. COOKE, U. S. N.,
President of the Torpedo Board.

Lieut. MARTIN E. HALL, U. S. N.,
Catskill, N. Y.

G G.

U. S. S. ATLANTA,
Newport, R. I., September 9, 18

SIR: I desire to submit to the Torpedo Board, as a design, the torpedo de-scribed and shown in the drawing herein inclosed.

This torpedo belongs to that class of torpedoes which are projected through air; but it is distinguished from others of this class in the fact that it explodes … the surface, and inflicts injury upon the hull. It is fired from an ordinary gun … ordinary powder and is exploded by means of an ordinary Borrmann fuze. This … fulminate of mercury, which ignites dry gun-cotton packed in the inside cylinder.

This torpedo, therefore, combines the speed and large carrying capacity of the "pneumatic dynamite projectile" with the simplicity and certainty of the smooth-bore gun, and with the destructive power of the submarine mine.

A torpedo similar to the one herein proposed was fired at the proving ground, Annapolis in the latter part of 1885. It was not fuzed or primed, though the outside the inner cylinder was filled with damp gun-cotton. The records of the … of Ordnance show that it was fired at a target near the muzzle with a velocity of about 300 foot-seconds, that the shell was ruptured to some extent on impact, that it rebounded 6 feet.

It is the design of this torpedo that it be fired at a ship's side with the fuze about two seconds longer than the time of flight, that it strike the side on the … ing part of its trajectory, rebound less than 15 feet, sink, and explode. The experiment above cited shows that under the unfavorable circumstances of high velocity and a flat trajectory it rebounded 6 feet. The writings of Commander … Sladen, and others, show that the radius of destructive effect of 100 pounds of gun-cotton is about 15 feet.

In the experiment mentioned above the plan proposed by me was to use a charge of powder to detonate the explosive; and Commander Folger reported the rupturing of the shell was sufficient to prevent this action, because gun-cotton can not be detonated by gunpowder unless strongly confined. But I beg to call the attention of the Board the fact that it was unnecessary to rely on gunpowder to do this, because fulminate of mercury can be used for this purpose with absolute safety. Fulminate of mercury is fired in the fuzes of rifle-shell all over the world even with the greatest acceleration of projectile. To make the matter doubly sure, however, the fulminate in this torpedo is put apart in a wooden box, as shown. Fulminate can not be detonated when lying between wood and wood. ("The M… High Explosives," by Manuel Eissler, page 131.)

If arranged with a fulminate fuze, the torpedo fired at Annapolis would have detonated within 6 feet of the target. The fact of the rupturing of the shell would not have affected the matter in the slightest then, provided that the torpedo held together as a mass. It is clear, also, from the well known action of fulminate of mercury that the torpedo would not have detonated on impact. In the drawing … inclosed the torpedo is shown as holding 100 pounds gun-cotton. There is no reason why it should not be larger and hold 500 pounds gun-cotton, for it would be thoroughly practicable in that size. But the small size is here shown, because a torpedo of this size is ready for trial at the proving ground; a gun is there also ready, and the molds from which the existing torpedo was made are doubtless ready and can be used to make others, with any modifications that may be shown by first trials to be advisable.

Besides its simplicity and certainty of launching I beg to call to the notice of the Board the fact that it possesses a curious advantage over all automobile torpedoes in the fact that it can not be dodged. On June 23, 1886, the *Iron Duke*, though going 9 knots, dodged three Whitehead torpedoes in succession by putting her helm … ("Recent Naval Progress, 1887," published by Office of Naval Intelligence, page …)

Besides the mechanical destruction of the hull of a ship by exploding a large … of gun-cotton near it, I desire to call to the recollection of the board the fact that the detonation of gun-cotton will cause the detonation of any mass of gun-cotton in its vicinity by "influence." From the experiments of Berthelot, it would appear that the distance over which such an effect can be produced is given roughly by the formula D C, where D is the distance in feet, and C is the charge in pounds. ("Explosive Material," Van Nostrand's Science, Series No. 70, pages 100 and 101.) A… King's "War Ships and Navies of the World," page 602, it is stated that 150 pounds of dynamite exploded charges 300 feet distant.

Thus we might expect that a torpedo such as here proposed, holding 200 pounds of gun-cotton, 25 inches diameter, and weighing loaded 650 pounds, would, if detonated … feet from a ship's side, detonate all the gun-cotton in the ship, and would not only break in the side by its own explosion but would compel the enemy's gun-cotton to assist in the work of demolition.

I desire to call the especial attention of the Board to the ease and cheapness

which this torpedo can be thoroughly tested; and to the fact that if such test prove satisfactory it will be in speed, certainty, simplicity, weigut, and destructive power superior to any other torpedo.

Very respectfully,

B. A. FISKE,
Lieutenant, U. S. N.

Capt. A. P. COOKE, U. S. N.,
Senior Member Torpedo Board.

Forwarded September 29, 1887.

F. M. BRUCE,
Captain, Commanding.

Forwarded by direction of Rear-Admiral Luce, commanding United States naval force on North Atlantic station.

J. S. ABBOTT,
Secretary.

II.

OCTOBER 21, 1887.

SIR: There will be a meeting of the Torpedo Board at this station on Thursday, October 27, which you are hereby directed to attend.

Respectfully,

A. P. COOKE, U. S. N.,
President of the Torpedo Board.

Commander C. F. GOODRICH, U. S. N.,
Torpedo Station, Newport, R. I.

OCTOBER 21, 1887.

SIR: There will be a meeting of the Torpedo Board at this station on Thursday, October 27, which you are hereby directed to attend.

Respectfully,

A. P. COOKE,
Captain, U. S. N., President of the Torpedo Board.

Lieutenant-Commander R. B. BRADFORD, U. S. N.,
Bureau of Navigation, Navy Department, Washington, D. C.

OCTOBER 21, 1887.

SIR: There will be a meeting of the Torpedo Board at this station on Thursday, October 27, which you are hereby directed to attend.

Respectfully,

A. P. COOKE,
Captain, U. S. N., President of Torpedo Board.

Lieut. S. P. COMLY, U. S. N.,
Navy-Yard, League Island, Philadelphia, Pa.

OCTOBER 21, 1887.

SIR: I have the honor to report that there will be a meeting of the Torpedo Board at this station on Thursday, October 27, 1887.

Very respectfully,

A. P. COOKE,
Captain, U. S. N., President of Torpedo Board.

CHIEF OF BUREAU OF ORDNANCE,
Navy Department, Washington, D. C.

J J.

CATSKILL, N. Y., *October* 19, 1887.

SIR: I have the honor to acknowledge the receipt of your letter of October 15.

Regarding the programme for preliminary trials, I would suggest several runs for direction and speed between buoys moored about 150 feet apart, some of the runs taking place during slack water, and others across the current.

After these trials, if an ordinary fisherman's net be made fast to the same buoys, runs can be made to test the efficiency of the device for overcoming the net defenses of ships of war.

I request that the following articles be furnished by the Government for the preliminary trials:

One float with moorings.

One crane and tackle for hoisting torpedo.

One boiler and 10-horse-power engine with pulley 10 inches or 12 inches in diameter and about 3½ inches width of force and heavy fly-wheel.

This engine will be used to work air compressed when charging the torpedo. The boiler will also be required to furnish steam for the impulse cylinder, which is 4 inches in diameter and 6 feet long. A pressure of from 60 to 80 pounds per square inch will be needed.

One strong leather belt 3½ inches wide. The pulley of my air compressor is inches in diameter and 3½ inches width of face; but the length of belt required not be stated till size of float that may be available is known.

One steam pipe and connections 1¼ inches in diameter to connect impulse cylinder with boiler.

One log line, or other instrument for determining the strength of the current.

Men to handle the torpedo, and run the engine and tend the boiler—the crew of a service steam-launch will suffice.

It will not be possible to fix the date until I hear further from the Navy Department regarding an extension of leave.

Very respectfully,

MARTIN E. HALL,
Lieutenant U. S. N.

Capt. A. P. COOKE, U. S. N.,
President of the Torpedo Board.

J J 1.

OFFICE OF THE TORPEDO BOARD,
New York Navy-Yard, October 28, 1

SIR: I have the honor to report that the Torpedo Board has decided to experiment with Hall's torpedo.

Lieutenant Hall, in a communication addressed to the Board, requests the following articles to be furnished by the Government for the preliminary trials:

One float with moorings.

One crane and tackle for hoisting torpedo.

One boiler and 10 horse-power engine with pulley 10 inches in diameter and 3½ inches width of face and heavy fly-wheel.

This engine to be used to work the air compressor when charging the torpedo, and the boiler is also needed to furnish steam for the impulse cylinder, which inches in diameter and 6 feet long. A pressure of from 60 to 80 pounds per square inch will be needed.

One strong leather belt 3½ inches wide and of necessary length for working pulley of air compressor

One steam pipe and connections 1¼ inches in diameter to connect impulse cylinder with boiler.

One log line for determining strength of current.

And the necessary men to handle the torpedo and run the engine and tend boiler.

The Board has decided to grant this request, subject to the approval of the Bureau.

Very respectfully,

A. P. COOKE,
Captain, U. S. N., President of the Torpedo Board.

CHIEF OF BUREAU OF ORDNANCE,
Navy Department, Washington, D. C.

J J.

[Indorsements on letter of October 28 to Chief of Bureau.]

[First indorsement.]

BUREAU OF ORDNANCE,
October 31, 18

Respectfully returned to Torpedo Board, approved.

The float is to be a camel in a temporary structure, to be built of spars, etc., borrowed of Construction and Repair, as far as practicable. The engine and boiler to be borrowed in the yard if possible, otherwise they may be hired.

M. SICARD,
Chief of B

[Second indorsement.]

OFFICE OF THE TORPEDO BOARD,
Navy-Yard, New York, November 14, 1887.

spectfully returned to the Bureau.

A. P. COOKE,
Capt., U. S. N., President Torpedo Board.

[Third indorsement.]

BUREAU OF ORDNANCE,
November 15, 1887.

spectfully returned to the torpedo station. The Bureau has indorsed the Hall pedo to be tested at the station.

Please inform the Bureau what articles (of those herein mentioned) are not on hand the station.

M. SICARD,
Chief of Bureau.

[Fourth indorsement.]

TORPEDO STATION,
November 8, 1887.

spectfully returned to the Bureau of Ordnance. The following articles are not on here: One float with moorings, one boiler, one leather belt, one steam-pipe and nections. The necessary men to handle the torpedo and run the engine and tend boiler can be employed. The 10 horse-power engine will require some slight re- rs before it can be used.

C. F. GOODRICH,
Commander and Inspector of Ordnance, in Charge of Torpedo Station.

[Fifth indorsement.]

BUREAU OF ORDNANCE,
November 19, 1887.

Respectfully returned. Which of the articles not on hand can be hired in the ighborhood, and at what prices?

M. SICARD,
Chief of Bureau.

[Sixth indorsement.]

TORPEDO STATION,
November 28, 1887.

Respectfully returned to the Bureau of Ordnance.

A pile-driver float, 40 feet long by 15 feet wide, with a boiler of ample capacity, and a hoisting engine which will probably prove suitable to Lieutenant Hall's wants, can be hired for $7.50 per diem, the wages of an engineer included. Other laborers will cost $2 per diem; the belt and piping can be bought at current market rates.

C. F. GOODRICH,
Commander and Inspector of Ordnance in Charge of Torpedo Station.

J J 2.

OFFICE OF THE TORPEDO BOARD.
Navy-Yard, New York, October 28, 1887.

DEAR SIR: The Torpedo Board desires to know if you have any choice as to the locality where you would wish to have take place the preliminary trials or experiments with your torpedo.

Also if you know of any suitable boiler that would answer your purpose.

The request that certain articles be furnished by the Government, contained in your letter, has been granted by the Board, subject to the approval of the Bureau.

Respectfully,

A. P. COOKE,
Captain, U. S. N., President of the Torpedo Board.

Lieut. MARTIN HALL, U. S. N.
Catskill, N. Y.

November 1, 1887.

SIR: I have the honor to acknowledge your communication of October 28.

Any locality considered suitable for trials of torpedoes by the Board will be agree able to me.

A 10 or 12 horse-power boiler capable of carrying a pressure of 100 pounds pe square inch would answer my purpose. The Herreshoff, or the service launch boiler or those of the New York Safety Steam Power Company, would be satisfactory.

Though the size of fly-wheel for the engine mentioned in my letter gives the num ber of revolutions recommended, I find that a higher speed gives better results, an I would prefer to have the diameter about 20 inches.

Thanking the Board for the assistance granted to carry on these trials,

I am, very respectfully, your obedient servant,

M. E. HALL,
Lieutenant, U. S. Navy.

Capt. A. P. COOKE, U. S. N.,
President of the Torpedo Board.

J J 4.

CATSKILL, NEW YORK,
November 11, 1887

DEAR SIR: I have just returned from Washington, and found your letter of the awaiting me. The revocation of my orders to sea will enable me to go ahead w this torpedo work, though I have lost two weeks' time altogether in getting them aside. The torpedo is now put together, but will be taken apart for the final adju ments to day. As it is necessary to have the proper appliances at hand to take torpedo apart, and as it requires nice mechanical work to put it together, I would pleased to have you or any other members of the Torpedo Board inspect the torpe at this stage, as it will not be feasible to take it apart at the trials. Of course la spanners could be made to unscrew the sections readily, but the time at my dispo will not admit of the manufacture of any more tools. But for the delay occasion by these orders I could have presented the torpedo for trial on the 30th. I will try do so now, but there may be a delay of a week or so. Are you familiar with a good ranges for torpedo experiments in the vicinity of Charleston, Savannah, F na-dina, or other point accessible by New York steamship lines? Pensacola prese attractions, but it is very inaccessible. If the torpedo goes south by rail there m be a delay of a month in transporting it.

A good heavy strain comes upon the air-compressor, so it should be a strong doub belt. After buying an air-compressor I found it necessary to build it over, and co pound it by adding a large cylinder before the machine would work up to its pre ure.

Very sincerely yours,

M. E. HALL.

Capt. A. P. COOKE, U. S. N.

K K.

OFFICE OF THE TORPEDO BOARD,
Navy Yard, New York, November 9, 1887.

SIR: There will be a meeting of the Torpedo Board at this station on Saturda the 12th instant, which you are hereby directed to attend.

Respectfully,

A. P. COOKE,

K K 1.

WASHINGTON CITY, *November* 8, 1887.

: The Navy Department desires that the trial of Hall's torpedo shall be made as little delay as possible.

this end the Bureau desires the articles requested in your letter of October 28, to be procured quickly in the manner stated in its indorsement of October 31, thereon. If this is not practicable, recommend some method to obtain them, r to expedite the trial.

I am, sir, your obedient servant,

M. SICARD,
Chief of Bureau.

Capt. A. P. COOKE,
President Torpedo Board.

L L.

OFFICE OF THE TORPEDO BOARD,
Navy-Yard, New York, November 12, 1887.

SIR: In order to save time and expense with the trials of the Hall torpedo the ard has decided, with the Bureau's consent, to have certain preliminary trials at wport, where facilities exist, instead of going immediately to a southern locality, recommended by the inventor.

The Board has the honor to request that the inspector of ordnance in charge of the pedo stations be directed to procure the articles needed for such experiments, as proved by the Bureau.

Very respectfully,

C. F. GOODRICH,
Commander U. S. N., Senior Member of Board.

EF OF BUREAU OF ORDNANCE,
Navy Department, Washington, D. C.

M M.

OFFICE OF TORPEDO BOARD,
Navy Yard, New York, November 12, 1887.

R: The Torpedo Board having advised the Bureau to have preliminary trials with torpedo at Newport, in order to expedite the same and save expense, you are eby notified that the Bureau has decided to furnish the articles mentioned in your tter, and that pending any action to the contrary, which is not likely, you may prepare for such trials at Newport at the earliest date possible.

To save time, no previous examination of your torpedo is considered advisable. ease fix this date and inform the Board.

Respectfully,

C. F. GOODRICH,
Commander, U. S. N., Senior Member of Board.

Lieut. MARTIN E. HALL, U. S. N.,
Catskill, N. Y.

N N.

OFFICE OF THE TORPEDO BOARD,
Navy-Yard, New York, November 12, 1887.

R: Will you please inform the Torpedo Board of the probable date at which you be ready to present the Howell torpedo for trial?

It is important that the preliminary experiments which, at your request, are to place at Newport, R. I., should be undertaken before the severe winter weather. ithout wishing your company to present the torpedo before you are fully pred, we would call your attention to the fact that the Board has been ready to prod with the preliminary trials at any time, and in July last made arrangements for ng for smooth-water trials under way; and further, the Board is of the opinion t your torpedo should be tested with as little delay as possible.

Very respectfully,

C. F. GOODRICH,
Commander, U. S. N., Senior Member of Board.

F. H. PAINE, Esq.,
President of the Howell Torpedo Company,
39 Corcoran Building, Washington, D. C.

O O.

OFFICE OF THE TORPEDO BOARD,
Navy-Yard, New York, November 12, 18.

DEAR SIR: This is to remind you that the Torpedo Board is ready to proceed with further trials of your torpedo as soon as you are prepared for them, and to suggest in view of the approach of inclement weather that the trials be held as soon as practicable.

Respectfully,

C. F. GOODRICH,
Commander, U. S. N., Senior Member of Board.

J. N. H. PATRICK, Esq.,
College Point, N. Y.

O O 1.

NEW YORK, *November 21, 18*

DEAR SIR: Yours of the 12th just reached me at this hotel to-day. We have had unavoidable delays, caused by accidents, in the completion of the new torpedo boat being constructed for the French Government. But it will be finished to-morrow and will be shipped at once to College Point, and we will be ready for trials next week if nothing unforeseen happens.

By the last of the week I will be able to inform your Board more definitely of the day. As I informed Captain Cooke, I arranged with the officers of the French commission that your Board might witness the trials they might make.

Yours, respectfully,

J. N. H. PATRICK.

Capt. C. F. GOODRICH,
Commander, U. S. Navy, Senior Member of Board, Navy-Yard, N. Y.

O O 2.

NEW YORK, *December 2,*

DEAR SIR: Your note 1st instant received. I am having some photographs of the French boat, and will send you one of each kind taken. I have no drawings of the boat, but will send you copies of the Patent Office drawings, which are complete, and you can have enlarged drawings made for your use at the station.

Will you kindly send me by return mail the map or plat of our course at College Point, which Mr. Haight let you have when you were there. You can take a copy or I will have one made and sent you.

I am in hopes that he will be able, weather permitting, to make the test trials last of next week for the French.

I will know by Monday, and will notify Captain Cooke and yourself.

Truly, yours,

J. N. H. PATRICK.

Capt. C. F. GOODRICH,
New York.

O O 3.

NEW YORK, *December 20, 18*

DEAR SIR: We have had extraordinary and unexpected delay in the completion and preliminary trials of the torpedo constructed for the French Government, and the officers sent here to make the tests could delay no longer, and the season is so far advanced that it is so very disagreeable to make trials that we have concluded to defer all operations until spring.

If your Board will continue the duties you are charged with until that time we will notify you, and give you all the trials you may require, and I am confident they will be to your entire satisfaction.

I have the honor to be, very respectfully, your obedient servant,

J. N. H. PATRICK.

Captain COOKE,
President Torpedo Board, Brooklyn Navy-Yard.

N N.

WASHINGTON, D. C., *December 22, 1*

SIR: I beg to acknowledge the receipt of your communication of the 12th ultimo, asking for the probable date at which we would be ready to present the Howell torpedo for trial.

I have delayed replying in order to give a definite answer in case the torpedo should be ready to bring the torpedo before the Board, and beg to say that

to the receipt of the Board's communication of August 24, 1887, appointing September 6, 1887, for trials, we had begun a series of progressive trials in consequence of iness proposals made to us. These trials are now concluded. The winter season so far advanced, however, that it would be difficult to make a full series of trials this latitude for the determination of speed, direction, and submersion. We would glad to make such trials for the inspection of the Board, if it suit the Board's conience, in the early spring, or when the weather at this port will permit.

Very respectfully,

F. H. PAINE,
President Howell Torpedo Company.

Commander C. F. GOODRICH, U. S. N.,
Senior Member Naval Torpedo Board.

N N 2.

WASHINGTON, D. C., *March* 4, 1888.

R CAPTAIN: Mr. Woodbury Blair is the new president and manager of this pany. All business as to manufacture, purchase, trials, etc., has been put in the ds of the Hotchkiss Ordnance Company, 21 rue Royale, Paris, France. Probably Howell Company will state this officially to the Bureau of Ordnance. I do not w yet whether the Hotchkiss Company will wish to exhibit before the Board but ink not, as they probably consider the requirements of the programme unneces-y severe to arrive at a comparison with torpedoes now in the market, and es-ally as no idea can be formed from it of what speed, size, weight, accuracy, rge, or other characteristic or quality would be satisfactory. No figures are given he programme as in the case of all other specifications for the ships, boats, guns, rine boats, and other war material. As no attention was paid to previous high alities (compared with size) offered by us (the Howell Company) to the Depart-nt, we can not tell what qualities are considered good. Nor do we know if the artment has any reliable official information of the performance and accuracy of Whitehead, to compare the Howell with.

think it more likely, without yet knowing their intentions, that the Hotchkiss any will guaranty the qualities found in the sample torpedoes now under way, state the price of such torpedoes, and if anybody wants any he will order them, f he prefers Whiteheads he will buy Whiteheads.

Very truly, yours,

F. H. PAINE.

P P.

OFFICE OF THE TORPEDO BOARD,
Navy-Yard, Norfolk, Va., June 23, 1888.

: There will be a meeting of the Tor edo Board at College Point, N. Y., on rday the 30th instant, for the purpose of witnessing experiments with the Patrick pedo, and you are hereby directed to attend.

Respectfully,

A. P. COOKE,
Captain, U. S. N., President of the Torpedo Board.

Capt. A. P. COOKE, N. Y.,
Norfolk, Va.
Commander C. F. GOODRICH,
Newport, R. I.
Lieut.-Commander R. B. BRADFORD,
Washington, D. C.
Lieut. A. R. COUDEN,
Washington, D. C.
Lieut. S. P. COMLY,
Nicetown, Pa.

Q Q.

155 MAPLE STREET, LYNN, MASS.,
April 26, 1888.

DEAR SIR: In a letter to me from Mr. Whitney, Secretary of the Navy, he said if I had any important improvements in my dynamite air-gun inventions I could bring them to the attention of the Torpedo Board. What I have to say is, when you were here to see the experiments in July, 1887, my No. 2 model (or system) was not in working order to show any good results in firing, except that air could be compressed the instant of firing by exploding the charge gunpowder. I will say since then I have so satisfied myself that No. 2 system is to be the best method that I have entirely

given up No. 1 model for guns of size large enough to be of any use, for the reason it costs too much to make them and they are liable to be broken in firing, and they could hardly be built to supply air for 6 or 8 inch guns at any reasonable expense, as they would be too cumbersome. I will say I have improved the general set-up and mechanism in my No. 2 gun, so it is perfect enough to prove exact. Uniform results can be had in firing, and by my new method of firing an important improvement is, I am sure. I have gained a most tremendous increase of pressure or power with the same amount of gunpowder; further, I have satisfied myself that gunpowder is good enough and equal in power, if not more powerful than gases or vapors from liquids which can be used if desired in the place of gunpowder; but I shall recommend a charge to be used (or a special cartridge) which contains no gunpowder or its ingredients, not to get more power. I have enough with gunpowder, but merely to create less smoke and fouling in the compressing or powder tube. I will say that it will be a charge of gun cotton made up to fit these guns, providing your Board consider it better than gunpowder (I myself do) for reasons above. I will say my model, now ready, has a [illegible] inch bore shot tube, and has fired lead bullets 4 inches into solid wood by air compressed, the instant of firing, by exploding a charge of gunpowder and the pressure of gas created following on up after the air, while the wad and all following matter is driven to a separate part, from which it is removed occasionally, or should be each time; with the gun on charge, once in twenty-five times to brush out the tube will be sufficient. The diaphragm head or valve is not blown out any more when firing, as I have described already. The air cushion against the projectile is very soft and perfect, creating no shock, and the report is more after the chew or puff of exhaust steam of a locomotive than a sharp report of a gun. The head or safety valve always renders it perfectly safe from explosion, or from the bursting of the tubes. I will say I now have this gun mounted on a carriage (not wheels) swinging on trunnions, and with a screw for elevating the gun. There is a screw plug at the breech to insert the charge, and the valve or head in front is quickly screwed on and off to allow brushing out the lower tube; but still, for all this, the model, although built exactly as I say, is not a fine piece of machinery at all, but every screw and every part will be fully shown, plain enough to copy to construct a nice gun by; and I will say I am to commence a gun with finely made mechanism, which with my means I can not have done for some time; and in the meantime I ask if the Board will examine what improvements I have made, or do you prefer to wait and see the better-made gun? I will say it has been a long and difficult work to get this gun to suit myself, but will now say I think the invention perfected. Mr. Whitney sent me an extract of your report; of course, all I expect to be able to do now is to get private parties to take an interest in my invention, but if the Government wants it I will guaranty a perfectly made gun with fine mechanism; I wish, if you examine the gun now made, to know it is only a model designed to build a nice one by, but I warrant the firing to be perfectly illustrated to you; in this (without thinking of money) I think I have solved the problem to perfection for a practical "dynamite air gun." If my request to have your Board examine the improvements in the mechanism or design of it, as above stated, I shall be prepared to show it to you at any time now; or if you desire to see a more perfect one in mechanism I shall have to ask for more time. I thought you could see this one in New York or here in Lynn, and the other when that is done (which may not be until fall), which I warrant will be as fine a model as ever was made in this country, as some time and money will be spent on it. I will say vapors and gas can be exploded in this system as well as the other explosives named, and also work well; but I prefer the more portable powders and explosives.

Yours, very respectfully,

DANA DUDLEY.

Capt. A. P. COOKE,
President of the Torpedo Board.

NAVAL ORDNANCE PROVING GROUND, ANNAPOLIS, MD.

MAY, 1, 188[illegible]

SIR: Herewith are respectfully forwarded range-tables for the 5-inch B. L. R., with 1,700-foot seconds and 2,000-foot seconds, respectively.

The following is a description of the manner in which these tables have been constructed:

Gun, 5-inch B. L. R. No. 1.

Mount, 5-inch G. R. carriage No. 1.

Fired from range battery at Naval Ordnance Proving Ground August 18, 1[illegible] December 7, 1887.

Height of trunnions above mean tide level, 5.4 feet.

Elevations fixed by quadrant.

The jump* was measured for every shot except 5, where the elevation was such as to render the use of a screen impracticable.

The powder used was P. V A.

The charges were fixed by ten rounds fired August 10, 1887, as per firing sheet inclosed.

From these rounds the charges were established as follows: For 1,700 foot-seconds, initial velocity, charge, 23½ pounds; for 2,000 foot-seconds, initial velocity, charge, pounds.

A preliminary calculation was made fixing theoretically the angles of departure the following ranges: 1,500 yards, 2,500 yards, 3,700 yards, 4,700 yards. These angles were used as angles of elevation in the firing.

Thirty-eight rounds were fired, or nineteen for each table, as follows: August 18, , at 1,500 yards, 2,500 yards, 3,700 yards, five rounds for each table; December 7, 1887, at 4,700 yards, four rounds for each table.

The line of fire was fixed by a stake planted on a shoal off Greensbury's Point, distant 1,400 yards from the gun.

The points of fall of the shots were noted by three plane-tables at ranging stations, and in a few cases, when the smoke allowed, by a theodolite in the line of fire in the r of the gun. To allow the use of this theodolite a staging had been erected in of the gun, 35 feet above the level of the trunnions, in the hope that an observer stationed at that height would be able to see above this smoke. This hope was not lized.

The velocity and direction of the wind, the height of tide, the barometer and thermometer, and the relative humidity were noted.

The point of fall of each shot was plotted upon the chart and the ranges taken off.

The mean range for each group was taken for the range for that group.

The angles for elevation were corrected for jump, and then, by the following method, for height of trunnions:

h = height of trunnions above tide level.
r = horizontal range (observed).
a = correction to be added to angle of elevation.

$$\tan a = \frac{h}{r}$$

The angles thus found (by applying correction for jump and height of trunnions) are the "angles of departure" of the projectiles.

From these angles of departure the ranges in vacuo were calculated by the formula

$$R = \frac{V^2}{g} \sin 2a$$

where

V = initial velocity.
a = angle departure.
g = acceleration of gravity.

The observed ranges corresponding to the different angles of departure were then corrected for wind, by the following formula:

$$C = \frac{W \cos a}{R}(R - r)t$$

in which

c = correction for wind.
W = velocity of wind in foot-seconds.
a = angle of wind with line of fire.
R = range in vacuo.
r = observed range.
t = time of flight (seconds).

These corrections were applied to the ranges observed.

To reduce the ranges to mean atmospheric conditions (Bar. 30.00, Ther. 62) the range for each angle of departure used was determined, theoretically.

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*In previous range-tables the mean jump has been determined by several rounds fired at level, and the jump assumed to be uniform for all elevations.

(1) For mean atmospheric conditions by the formulæ

$$\text{Sin } 2\vartheta = \frac{W}{d^2}\left(\frac{Av - Aq}{Sv - Sq} - Iq\right)$$

(page 58, Meigs-Ingersoll's Exterior Ballistics) and $\frac{d^2}{W} S = Sv - Sq$.
(page 61, Meigs-Ingersoll's Exterior Ballistics.)

(2) For the atmospheric conditions existing at the time of firing by the formula

$$\text{Sin } 2\vartheta = \frac{W}{d^2\Delta}\left(\frac{Av - Aq}{Sv - Sq} - Iq\right)$$

$$\frac{d^2 \Delta S}{W} = Sv - Sq$$

Here Δ is found by the formula

$\Delta = W - W_0$

in which, W_0 weight of cubic foot of air when
Ther. 62° F. Bar. 30".00

W=weight cubic foot of air under actual atmospheric conditions$=\frac{534.22 \times B}{1 + .002175 \times}$

(page 37, Meigs-Ingersoll's Exterior Ballistics.)

B = Barometric height.

t = difference between actual temperature and standard temperature.

The differences between the theoretical ranges as above determined, first for standard and second for actual atmospheric conditions, give the corrections to be applied to the observed ranges to reduce them to ranges under standard atmospheric conditions.

These corrections were applied to the observed ranges as previously corrected for wind.

With the ranges thus corrected a curve was plotted, in the usual manner, with the angles of departure as ordinates and the ranges as abscissæ, and from this curve the angles of departure were taken off for every 100 yards of range.

With the angles of departure thus found, the remaining velocities and angles of fall were calculated for every 500 yards. (Exterior Ballistics, page 58, formulæ 47 and 4 and found by interpolation for the intervening points.

A second curve was now constructed with the angles of elevation as ordinates and the ranges corresponding as abscissæ, and from this curve were taken off the angles of elevation for every 100 yards of range, and also the range for every 30 feet of elevation.

The times of flight were fixed partly by observation and partly by calculation, theory and practice being found to agree.

The formula used was

$$T = \frac{W}{d^2 \cos \vartheta}(Fv - Fq)$$

in which

W=weight of projectile.

d=diameter of shot in inches.

ϑ=angle of departure.

(Page 53 and tables, Meigs-Ingersoll's Exterior Ballistics.)

The deflections were taken from the chart and corrected for force and direction of wind by the formula

$$C = AB \tan \alpha$$

in which

A=correction for wind in direction of line of fire.
(already found and applied to range.)

B=ratio between areas of transverse and longitudinal sections of projectile.

α=angle of wind with line of fire.

A curve was constructed with the deflections thus obtained, and from it the corrections are taken off for every hundred yards.

With regard to these tables as completed, I would say that they are very satisfactory to me except in one point of deviations. These, as observed, were not regular and the column embodied in the table is the result of much more approximating smoothing up of curves than I am able to accept without placing upon record a statement of the fact. This is a trouble which is more or less inherent in the nature of our range and of the situation of the station. We are compelled to take advantage for firing on occasion when the range is clear, and can not choose such conditions of weather as would be most suitable, though of course no firing is done on days conspicuously unsuitable.

observation of a splash so large as that made by a 5-inch projectile is subject to ..uracy, from the impossibility of getting all lines to converge at the center. In ntities as large as are the ranges, this and errors connected with the variations in lirection and force of the wind, and in the correction for the effect of the wind, .rifling, never amounting to more than a few yards, but in the deviations a few ..is very important.

th the exception of the deviations, the tables are, as already stated, very satis-ory to me. The observations have been uniform and have fallen into unusually oth curves.

Respectfully, etc.,

AUSTIN M. KNIGHT,
Lieutenant, Inspector Ordnance, in charge.

CHIEF OF BUREAU OF ORDNANCE,
Navy Department, Washington, D. C.

The telephone outfit to be supplied to ships for establishing communication be-'een the ship and the shore or a boat consists of—

Two or more miles of light, but strong and flexible, double-conductor cable, and 'o portab e boxes, each containing a magnetic call, a two-point switch, and a speak-and a transmitting telephone.

... using the apparatus, one end of the cable is run to the shore, sinkers being at-hed to the cable at intervals by means of snap-hooks to sink it. To prevent the .ling of the cable by the ship in swinging, a buoy is moored just outside the sweep the ship, having on its moving line a weighted ring through which the cable is sed. The ring being let go slips to the bottom, carrying with it the bight of the .le. The portion of the cable between the buoy and ship is tended as necessary n the latter swings.

(1) For mean atmospheric conditions by the formulae

$$\text{Sin } 2\vartheta = \frac{W}{d^2}\left(\frac{Av-Aq}{Sv-Sq} - Iq\right)$$

(page 58, Meigs-Ingersoll's Exterior Ballistics) and $\frac{d^2}{W} S = Sv - Sq$.

(page 61, Meigs-Ingersoll's Exterior Ballistics.)

(2) For the atmospheric conditions existing at the time of firing by the formula.

$$\text{Sin } 2\vartheta = \frac{W}{d^2\Delta}\left(\frac{Av-Aq}{Sv-Sq} - Iq\right)$$

$$\frac{d^2\Delta S}{W} = Sv - Sq$$

Here Δ is found by the formula

$$\Delta = W - W_0$$

in which, W_0 weight of cubic foot of air when Ther. 62° F. Bar. 30''.00

W=weight cubic foot of air under actual atmospheric conditions$=\frac{534.22 \times B}{1+.002178 \times t30.00}$

(page 37, Meigs-Ingersoll's Exterior Ballistics.)

B = Barometric height.

t = difference between actual temperature and standard temperature.

The differences between the theoretical ranges as above determined, first for standard and second for actual atmospheric conditions, give the corrections to be applied to the observed ranges to reduce them to ranges under standard atmospheric conditions.

These corrections were applied to the observed ranges as previously corrected for wind.

With the ranges thus corrected a curve was plotted, in the usual manner, with the angles of departure as ordinates and the ranges as abscissæ, and from third curve the angles of departure were taken off for every 100 yards of range.

With the angles of departure thus found, the remaining velocities and angles of fall were calculated for every 500 yards. (Exterior Ballistics, page 58, formulæ 47 and 48), and found by interpolation for the intervening points.

A second curve was now constructed with the angles of elevation as ordinates and the ranges corresponding as abscissæ, and from this curve were taken off the angles of elevation for every 100 yards of range, and also the range for every 30 feet of elevation.

The times of flight were fixed partly by observation and partly by calculation, the theory and practice being found to agree.

The formula used was

$$T = \frac{W}{d^2 \cos \vartheta}(Fv. - Fq)$$

in which

W=weight of projectile.

d=diameter of shot in inches.

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(Page 53 and tables, Meigs-Ingersoll's Exterior Ballistics.)

The deflections were taken from the chart and corrected for force and direction of wind by the formula

$$C = AB \tan \alpha$$

in which

A=correction for wind in direction of line of fire.

(already found and applied to range.)

B=ratio between areas of transverse and longitudinal sections of projectile.

α=angle of wind with line of fire.

A curve was constructed with the deflections thus obtained, and from it the deflections are taken off for every hundred yards.

With regard to these tables as completed, I would say that they are very satisfactory to me except in one point of deviations. These, as observed, were not regular, and the column embodied in the table is the result of much more approximating and smoothing up of curves than I am able to accept without placing upon record a statement of the fact. This is a trouble which is more or less inherent in the nature of our range and of the situation of the station. We are compelled to take advantage for firing on occasion when the range is clear, and can not choose such conditions of weather as would be most suitable, though of course no firing is done on days conspicuously unsuitable.

The observation of a splash so large as that made by a 5-inch projectile is subject to inaccuracy, from the impossibility of getting all lines to converge at the center. In quantities as large as are the ranges, this and errors connected with the variations in the direction and force of the wind, and in the correction for the effect of the wind, are trifling, never amounting to more than a few yards, but in the deviations a few yards is very important.

With the exception of the deviations, the tables are, as already stated, very satisfactory to me. The observations have been uniform and have fallen into unusually smooth curves.

Respectfully, etc.,

AUSTIN M. KNIGHT,
Lieutenant, Inspector Ordnance, in charge.

CHIEF OF BUREAU OF ORDNANCE,
Navy Department, Washington, D. C.

The telephone outfit to be supplied to ships for establishing communication between the ship and the shore or a boat consists of—

Two or more miles of light, but strong and flexible, double-conductor cable, and two portab e boxes, each containing a magnetic call, a two-point switch, and a speaking and a transmitting telephone.

In using the apparatus, one end of the cable is run to the shore, sinkers being attached to the cable at intervals by means of snap-hooks to sink it. To prevent the fouling of the cable by the ship in swinging, a buoy is moored just outside the sweep of the ship, having on its moving line a weighted ring through which the cable is passed. The ring being let go slips to the bottom, carrying with it the bight of the cable. The portion of the cable between the buoy and ship is tended as necessary when the latter swings.

No. 8.—BUREAU OF CONSTRUCTION AND REPAIR.

NAVY DEPARTMENT,
BUREAU OF CONSTRUCTION AND REPAIR,
October 31, 1888.

SIR: In obedience to the Department's instructions I have the honor to submit my annual report for the fiscal year ending June 30, 1888, showing the work performed and the amount expended, together with estimates of the amounts required for the purpose of the Bureau for the fiscal year ending June 30, 1890.

The estimates for the expenses of this Bureau, as given in the statement marked A, are in accordance with existing laws.

An estimate is submitted for a chief draughtsman of this Bureau, this rating having been for several years allowed in the Bureau of Steam-Engineering.

Mr. William T. Powell, the present head draughtsman of this Bureau, is in every way qualified for this position, not only for his ability to make the calculations and carry out the practical work required in one holding so responsible a position, but also that, from his long experience in the designing of men-of-war, his opinion is of the greatest value in all that pertains to their fitting and equipment.

The establishment of the rating of chief draughtsman and the appointment of Mr. Powell to that position would be an act of justice to one whose long, faithful, and efficient services at a small rate of remuneration entitle him to a substantial advancement.

The estimates in statement marked C is for the pay of clerks and writers at the several navy-yards whose services are indispensable for the proper and systematic prosecution of the work which is required to be done at the yards by the Bureau.

The estimate marked B is for the general repair of vessels at navy-yards and on foreign stations, purchase of stores, material, machinery, rights of patent articles, and tools of all kinds, preservation of materials and stores, and for the general care and protection of the Navy in the line of construction and repair; and the estimate marked D for the hulls and outfits of new vessels, and the improvement of the plants at the navy-yards.

The Bureau recommends the immediate construction of experimental works to cost $60,000, for use in the determination of the resistance and other qualities of ships by means of models.

Such tanks as are recommended now form an invaluable and important part of the ship-designing branch of foreign naval establishments, and the Bureau is convinced of their permanent value in designing high-speed vessels and in analyzing the results of ships' trials.

The system is in theory comparatively simple, being that of towing a paraffine model of 10 feet in length in a covered tank about 300 feet long, and measuring the resistance at different speeds. The models being made of paraffine and being shaped by machinery are very cheap, but the dynamometrical apparatus is costly, being of exceeding delicacy and in all respects automatic.

The English Admiralty have had such experimental works in operation since 1874, and the comparatively few publications of the investigations made by the eminent Messrs. Froude are of inestimable value to naval architects.

The system is of such economical value that Messrs. Wm. Denny & Bros., ship-builders, of Dumbarton, Scotland, have established similar works for their sole use.

The sloop of war *Hartford* is likely to be condemned, because the cost of her repairs exceeds the 20 per cent. limit, unless the act passed by the House of Representatives authorizing her repairs becomes a law. She was built at the Boston navy-yard in 1858, and is now at the navy-yard, Mare Island. She is a screw steamer of about 2,900 tons displacement, 225 feet long, 44 feet wide, and draws 18 feet 6 inches of water. I made a personal examination of this vessel about a year ago and found that her live-oak frames above and below water are sound. I am of the opinion that she can be repaired within the amount, $175,000, called for by the Board of Survey. She would then be valuable for service as a cruiser for several years. Her past record as Admiral Farragut's flag-ship, victorious in battle both over iron clads and forts, not only endears her to the American people, but when she has outlived her usefulness as a cruiser she should be preserved as a receiving-ship as a monument of her past achievements.

Appended hereto, marked E, is a list of the vessels which have been repaired at the different navy-yards during the fiscal year 1887–'88; also a statement, marked F, of the expenditures under the different appropriations during the year.

The adaptability of the monitor to the coast defense leads me to call again your attention to the single-turreted monitors in the possession of the United States. They are now a considerable expense to the Navy, as they must be taken care of, and not being in proper repair they are of but little use to the country in their present condition.

Appended hereto, marked G is a list of the vessels of the Navy, divided into groups under the heads of "Armored vessels," "Steel and iron armored vessels," "Wooden steam-vessels," "Sailing vessels," and "Tugs."

All the tugs now belonging to the Navy, as will be seen from the appended tables of tugs, are old, most of them being relics of the late war; they are unhandy and unsuited to the needs of our navy-yards, and require expensive repairs from year to year.

There should be built, for use in towing and other purposes at the navy-yards, 6 tugs of about 200 tons displacement.

Appended hereto, marked H, is a statement of the condition of the various vessels now building for the Navy, under contract, up to October 1, 1888.

To give effect to the clause in the act of August 3, 1886, appropriating $150,000 for the purchase of tools for ship-building plant, boards were appointed to decide upon the character and location of tools in the construction department of the navy-yards at New York and Norfolk, $75,000 being allotted to each yard. These tools are now being

delivered, and we shall soon be in possession of two yards well equipped for building steel and iron vessels of war of every size and type.

The navy-yard, Mare Island, being the only one on the Pacific coast, is now being fitted with a complete outfit of modern ship-building tools.

The climate is such that it is perfectly practicable to conduct ship-building without the shelter of ship-houses, which are expensive, both in first cost and repairs, and do not favor rapidity of construction or excellency of workmanship, on account of the darkness.

The temperature in winter is never cold, nor in summer is it warm enough to make outside labor uncomfortable.

Plans are now being prepared for the location of the necessary plant.

I am, sir, very respectfully, your obedient servant,

THEODORE D. WILSON,
Chief Constructor, U. S. Navy,
Chief of Burea.

Hon. W. C. WHITNEY,
Secretary of the Navy.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1890, by the Bureau of Construction and Repair.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1889.
A—SALARIES.		
Chief clerk (appropriated)	$1,800.00	
One draughtsman (appropriated)	1,800.00	
One assistant draughtsman (appropriated)	1,600.00	
One assistant draughtsman (appropriated)	1,400.00	
One clerk of class four (appropriated)	1,800.00	
One clerk of class three (appropriated)	1,600.00	
One clerk of class two (appropriated)	1,400.00	
One clerk of class one (appropriated)	1,200.00	
One assistant messenger (appropriated)	720.00	
One laborer (appropriated)	660.00	
One chief draughtsman (submitted)	2,500.00	
(The largely increased amount of work of a professional nature coming into the draughting-room, in connection with building our new Navy, clearly demonstrates the necessity for a chief draughtsman, who can be held responsible for the proper performance of the duties of the other draughtsmen. I earnestly request that the Bureau be allowed a chief draughtsman.)	16,480.00	$13,880.00
B—CONSTRUCTION AND REPAIR OF VESSELS.		
Preservation and completion of vessels on the stocks and in ordinary; purchase of materials and stores of all kinds, and patented articles; for steam steerers, pneumatic steerers, steam capstans, steam windlasses, and other steam auxiliaries; labor in navy-yards and on foreign stations; purchase of machinery and tools for use in shops; wear, tear, and repair of vessels afloat, and for general care, increase and protection of the Navy in the line of construction and repair; incidental expenses, such as advertising, freight, foreign postage, telegrams, photographing, books, plans, stationery, and instruments for draughting-room (appropriated)	900,000.00	825,000.00
C—CIVIL ESTABLISHMENT.		
At the navy-yard, Portsmouth, N. H. (appropriated):		
One clerk to naval constructor	1,400.00	
Two writers, at $1,017.25 each	2,034.50	
At the navy-yard, Boston, Mass. (appropriated):		
One clerk to the naval constructor	1,400.00	
At the navy-yard, Brooklyn, N. Y. (appropriated):		
One clerk to naval constructor	1,400.00	
Three writers, at $1,017.25 each	3,051.75	
At navy-yard, League Island, Pa. (appropriated):		
One clerk to naval constructor	1,400.00	
At navy-yard, Washington, D. C. (appropriated):		
One clerk to naval constructor	1,400.00	
At navy-yard, Norfolk, Va. (appropriated):		
One clerk to naval constructor	1,400.00	
Two writers, at $1,017.25 each	2,034.50	
At navy-yard, Pensacola, Fla. (appropriated):		
One writer	1,017.25	
At navy-yard, Mare Island, Cal. (appropriated):		
One clerk to naval constructor	$1,400.00	
Two writers, at $1,017.25 each	2,034.50	
	19,972.50	$19,972.50
D.		
Improvement of the plant at the navy-yard, New York:		
Additional tools, other than those heretofore authorized, required to further improve the condition of the yard for building and repairing iron and steel ships (appropriated)	50,000.00	
Improvement of the plant at the navy-yard, New York:		
Construction of experimental tank for use in the determination of the resistance and other qualities of ships by means of models (submitted)	60,000.00	
Improvement of plant at the navy-yard, Norfolk, Va:		
Additional tools, other than those heretofore authorized, required to further improve the condition of the yard for building and repairing iron and steel ships (appropriated)	50,000.00	
INCREASE OF THE NAVY.		
On account of hulls and outfits of new ships heretofore authorized by Congress (appropriated)	3,540,000.00	

G.—*Tables of vessels*

ARMORED

DOUBLE

Name of vessel.	Type.	Keel laid.	Where built.	Condition.	Length between perpendiculars.	Breadth.	Mean draught.	Displacement.	Indicated horse-power.
					Ft.	*Ft.*	*Ft. In.*	*Tons*	
Puritan	Double-turreted monitor.	1875	Roach's yard, Chester, Pa.	Awaiting completion.	280	60	18 2	6060	3058*
Miantonomoh	....do	1874	......do	....do	250	$55\frac{1}{2}$	14 $1\frac{3}{4}$	3815	1030†
Amphitrite	....do	1874	Harlan & Hollingsworth, Wilmington, Del.	....do	250	$55\frac{1}{2}$	14 $1\frac{1}{2}$	3815	1000‡
Monadnock	....do	1874	U. S. navy-yard, San Francisco.	....do	250	$55\frac{1}{2}$	4 $1\frac{3}{4}$	3815	3000‡
Terror	....do	1874	Cramp's, Philadelphia, Pa.	....do	250	$55\frac{1}{2}$	14 $1\frac{3}{4}$	-815	838*
Texas	Belted	....	U. S. navy-yard, Norfolk, Va.	Preparing ways.	290	$64\frac{1}{12}$	22 6	6300	8600‡
Maine	......do	....	U. S. navy-yard, New York.	Building	310	57	21 6	6648	9000‡

SINGLE-TURRETED

Name of vessel.	Type.	Keel laid.	Where built.	Condition.	Length between perpendiculars.	Breadth.	Mean draught.	Displacement.	Indicated horse-power.
Ajax	Single-turreted monitor.	1862	Snowdons & Mason, Pittsburgh, Pa.	In ordinary.	225	$43\frac{5}{8}$	13 6	2100	340
Comanche	....do	1862	Donahue, Ryan & Secor, Jersey City, N. J.	....do	200	46	11 6	1875	340
Canonicus	....do	1862	Harrison Loring, Boston, Mass.	....do	225	$43\frac{5}{8}$	13 6	2100	340
Catskill	....do	1863	John Ericsson, Brooklyn, N. Y.	....do	200	46	11 6	1875	340
Jason	....do	1862	John Ericsson, Chester, Pa.	....do	200	46	11 6	1875	340
Lehigh	....do	1863	......do	....do	200	46	11 6	1875	340
Mahopac	....do	1862	Z. & F. Secor, Jersey City, N. J.	....do	225	$43\frac{5}{8}$	13 6	2100	340
Manhattan	....do	1862	Perine, Secor & Co., Jersey City, N. J.	....do	225	$43\frac{5}{8}$	13 6	2100	340
Montauk	....do	1862	John Ericsson, Brooklyn, N. Y.	....do	200	46	11 6	1875	340
Nahant	....do	1863	Harrison Loring, Boston, Mass.	....do	200	46	11 6	1875	340
Nantucket	....do	1863	Atlantic Works, Boston, Mass.	....do	200	46	11 6	1875	340
Passaic	....do	1862	John Ericsson, Brooklyn, N. Y.	....do	200	46	11 6	1875	340
Wyandotte	....do	1862	Miles Greenwood, Cincinnati, Ohio.	....do	225	$43\frac{5}{8}$	13 6	2100	340

* Dock trial. † Free route trial. ‡ Estimated.

of the U. S. Navy.

VESSELS.

TURRETED.

Type of engines.	Speed in knots.	Batteries. Main.	Batteries. Secondary.	Armor. Sides.	Armor. Turrets and barbettes.	Cost of hull and machinery.	Date of act authorizing building.
Twin-screw horizontal compound.	13	4 10″ B. L. R ..	2 6-pdrs. R. F., 2 3-pdrs. R. F., 2 37mm R. C., 2 Gatlin. s.	12″	11½″	To complete, $3,178,016.	Mar. 3d, '85, Aug. 3d, '86, Mar. 3d, '87.
Twin-screw inclined compound.	10.5	....do	2 6-pdrs. R. F., 2 37mm R. C., 2 Gatlings.	7″	11½″		Mar. 3d, '85, Aug. 3d, 86, Mar. 3d, '87.
.... do	12	....do	....do	7″	11½″		Mar. 3d, '85, Aug. 3d, '86, Mar. 3d, '87.
Twin-screw horizontal, triple expansion.	12	....do	....do	7″	11½″		Mar. 3d, '85, Aug. 3d, '86, Mar. 3d, '87.
....do	12	....do	....do	7″	11½″		Mar. 3d, '85, Aug. 3d, '86, Mar. 3d, '87.
Twin-screw vertical, triple expansion.	17	2 12″ B. L. R. 6 6″ B. L. R.	4 6 pdr. R. F., 8 3-pdrs., 4 1-pdrs., 4 37mm R. C., 2 Gatlings.	12″	12″	$2,376,000	August 3, 1886.
....do	17	4 10″ B. L. R. 6 6″ B. L. R.	4 6 pdrs., 8 3-pdrs., 4 37mm R. C., 4 Gatlings, 2 1-pdrs.	11″	10½″	2,844,503	Do.

MONITORS.

Single-screw grasshopper.	5.6	2 15″ S. B.....	None	5″	10″	620,582.24	April 17, 1862.
....do	5.6	....do	....do	5″	11″	613,164.98	Do.
....do	6	....do	....do	5″	10″	622,963.22	Do.
....do	6	...do	....do	5″	11″	427,766.78	Do.
...do	5.6	....do	... do	5″	11″	422,766.73	Do.
....do	5.6	... do	....do	5″	11″	422,726.28	Do.
....do	6	....do	....do	5″	10″	635,374.55	Do.
....do	6	....do	... do	5′	10″	628,879,27	Do.
....do	5.6	...do	....do	5″	11″	423,027.49	Do.
...do	5.6	...do	....do	5″	11″	413,515.14	Do.
...do	5.7	...do	....do	5″	11″	408,091.37	Do.
....do	5.6	.. do	....do	5″	11″	423,171.69	Do.
...do	6	.. do	... do	5″	10″	633,327.84	Do.

G.—*Tables of vessels of the*

UNARMORED STEEL

Name.	Type.	Keel laid.	Where built.	Condition.	Dimensions. Length between perpendiculars.	Dimensions. Beam.	Dimensions. Mean draught.	Displacement.	Collective indicated horse-power or speed.
					Feet.	*Feet.*	*Feet.*	*Tons.*	
Chicago	Protected cruiser.	1883	Roach's	Commissioned.	315	$48\frac{1}{6}$	19	4,500	*5,084
Boston	...do	1883	...do	...do	270	42	17	3,189	*3,780
Atlanta	...do	1883	...do	...do	270	42	17	3,189	*3,356
Dolphin	Dispatch vessel.	1883	...do	...do	240	32	$14\frac{1}{4}$	1,485	*2,240
Newark	Protected cruiser.	...	Cramp's	Building	310	$49\frac{1}{6}$	$18\frac{3}{4}$	4,083	†8,500
Charleston	...do	1887	Union Iron Works.	Launched	300	46	$18\frac{1}{2}$	3,730	§7,000
Baltimore	...do	1887	Cramp's	...do	315	$48\frac{1}{2}$	$19\frac{1}{2}$	4,413	†9,500
Philadelphia	...do	1888	...do	Building	315	$48\frac{1}{2}$	$19\frac{5}{24}$	4,324	‡19 knots.
San Francisco	...do	1888	Union Iron Works.	...do	310	$49\frac{1}{6}$	$18\frac{3}{4}$	4,083	‡19 knots.
Yorktown	Gunboat	1887	Cramp's	Launched	230	36	14	1,700	§3,000
Petrel	...do	1887	Columbian Iron Works, Baltimore.	...do	175	31	$11\frac{7}{12}$	890	§1,100
Concord	...do	1888	N. F. Palmer, jr., & Co., Chester, Pa.	Building	230	36	14	1,700	§3,400
Bennington	...do	1888	...do	...do	230	36	14	1,700	§3,400
Vesuvius		1887	Cramp's	Ready for trial.	$246\frac{1}{4}$	$26\frac{5}{12}$	9	725	‡20 knots.
First-class torpedo boat.		1888	Herreshoff Manufacturing Company, Bristol, R. I.	Building	135	15	$3\frac{7}{12}$	99	‖23 knots.

* Indicated horse-power on trial.
† Estimated.
‡ Guarantied speed.
§ Guarantied indicated horse-power.
‖ Estimated speed by bidder.

ry—Continued.

ON VESSELS.

f engines.	Speed in knots.	Batteries. Main.	Batteries. Secondary.	Total contract cost of hull and machinery.	Date of act authorizing building.	Contract signed.	Time to complete from date of contract.
							Mos.
rew com- ,overhead	14.0	4 8" B. L. R.. 8 6" B. L. R. 2 5" B. L. R.	2 6-pdr. R. F.. 4 47^{mm} R. C. 2 37^{mm} R. C. 2 1-pdr. R. F. 2 Gatlings.	$889,000	Mar. 3, 1883	July 26, 1883	......
crew hori- al com- l.	14.0	2 8" B. L. R 6 6" B. L. R.	2 Gatlings .. 2 6-pdr. R. F. 2 3-pdr. R. F. 2 47^{mm} R. C. 2 37^{mm} R. C. 2 1-pdr. R. F.	619,000	Same as Chicago.	July 23, 1883	......
....	16.33	Same as Boston.	Same as Boston.	617,000	....do	....do	......
crew ver- ompound.	15.5	1 6" B. L. R	4 47^{mm} R. C.. 2 6-pdr. R. F. 2 Gatlings.	315,000	...do	....do	......
rew hori- ,triple ex- n.	18.0	12 6" B. L. R ..	4 6-pdr. R. F . 3 37^{mm} R. C. 2 1-pdr. R. F. 4 3-pdr. R. F. 4 Gatlings.	1,248,000	Mar. 3, 1886	Oct. 27, 1887	24
rew hori- al com- l.	18.0	2 8" B. L. R 6 6" B. L. R.	4 6-pdr. R. F .. 4 37^{mm} R. C. 2 3-pdr. R. F. 2 1 pdr. R. F. 2 Gatlings.	1,017,000	Mar. 3, 1885	Dec. 28, 1886	18
rew hori- l, triple ex- n.	19.0	4 8" B. L. R. 6 6" B. L. R.	2 Gatlings .. 4 6-pdr. R. F. 2 3-pdr. R. F. 2 1 pdr. 4 37^{mm} R. C.	1,325,000	Aug. 3, 1886	Dec. 17, 1886	18
....	19.0	12 6" B. L. R..	4 6-pdr. R. F . 4 3 pdr. R. F. 2 1-pdr. R. F. 3 37^{mm} R. C. 4 Gatlings.	1,350,000	Mar. 3, 1887	Oct. 27, 1887	24
....	19.0	.. do	Same as Philadelphia.	1,428,000	...do	Oct. 26, 1887	24
....	16.0	6 6" B. L. R..	2 Gatlings .. 2 6-pdr. R. F. 2 3-pdr. R. F. 1 1-pdr. R. F. 2 37^{mm} R. C.	455,000	Mar. 3, 1885	Jan. 31, 1887	12
crew hori- al com- l.	13.0	4 6" B. L. R.	2 3-pdr. R. F . 1 1-pdr. R. F. 2 37^{mm} R. C. 2 Gatlings.	247,000	....do	Dec. 22, 1886	12
rew hori- l, triple ex- n.	16.0	Same as No. 1	Same as Yorktown.	490,000	Mar. 3, 1887	Nov. 15, 1887	18
....	16.0	...do	.. do	490,000	...do	...do	18
rew verti- iple expan-	20.0	3 dynamite guns, 15" caliber.	2 3-pdr. R. F . 1 1 pdr. R. F. 2 37^{mm} R. C. 2 Gatlings.	a350,000	Aug. 3, 1886	Feb. 11, 1887	12
rew ver- quadruple nsion.	22.0	8 automobile torpedoes.	2 6-pdr. R. F ..	82,750	...do	Mar. 1, 1888	......

a Including dynamite guns, etc.

G.—*Tables of vessels of the*

UNARMORED STEEL

Name.	Type.	Keel laid.	Where built.	Condition.	Dimensions. Length between perpendiculars.	Dimensions. Beam.	Dimensions. Mean draught.	Displacement.	Collective indicated horse-power, or speed.
					Feet.	*Feet*	*Feet.*	*Tons.*	
Chicago	Protected cruiser.	1883	Roach's	Commissioned.	315	48½	19	4,500	*5,084
Boston	... do	1883	... do	... do	270	42	17	3,189	*3,780
Atlanta	... do	1883	... do	... do	270	42	17	3,189	*3,356
Dolphin	Dispatch vessel.	1883	... do	... do	240	32	14½	1,485	*2,240
Newark	Protected cruiser.	...	Cramp's	Building	310	49⅓	18¾	4,083	†8,500
Charleston	... do	1887	Union Iron Works.	Launched	300	46	18½	3,730	§7,000
Baltimore	... do	1887	Cramp's	... do	315	48½	19½	4,413	†9,500
Philadelphia	... do	1888	... do	Building	315	48½	19$\frac{5}{12}$	4,324	‡19 knots.
San Francisco	... do	1888	Union Iron Works.	... do	310	49⅓	18¾	4,083	‡19 knots.
Yorktown	Gunboat	1887	Cramp's	Launched	230	36	14	1,700	§3,000
Petrel	... do	1887	Columbian Iron Works, Baltimore.	... do	175	31	11$\frac{7}{12}$	890	§1,100
Concord	... do	1888	N. F. Palmer, jr., & Co., Chester, Pa.	Building	230	36	14	1,700	§3,400
Bennington	... do	1888	... do	... do	230	36	14	1,700	§3,400
Vesuvius	....	1887	Cramp's	Ready for trial.	246½	26$\frac{5}{12}$	9	725	‡20 knots.
First-class torpedo boat.	....	1888	Herreshoff Manufacturing Company, Bristol, R. I.	Building	135	15	3$\frac{7}{12}$	99	‖23 knots.

* Indicated horse-power on trial.
† Estimated.
‡ Guarantied speed.
§ Guarantied indicated horse-power.
‖ Estimated speed by bidder.

ry—Continued.

ON VESSELS.

f engines.	Speed in knots.	Batteries. Main.	Batteries. Secondary.	Total contract cost of hull and machinery.	Date of act authorizing building.	Contract signed.	Time to complete from date of contract.
							Mos.
rew com- , overhead	14.0	4 8" B. L. R. 8 6" B. L. R. 2 5" B. L. R.	2 6-pdr. R. F. 4 47mm R. C. 2 37mm R. C. 2 1-pdr. R. F. 2 Gatlings.	$889,000	Mar. 3, 1883	July 26, 1883	......
crew hori- al com- l.	14.0	2 8" B. L. R 6 6" B. L. R.	2 Gatlings 2 6-pdr. R. F. 2 3-pdr. R. F. 2 47mm R. C. 2 37mm R. C. 2 1-pdr. R. F.	619,000	Same as Chicago.	July 23, 1883	......
....	16.33	Same as Boston.	Same as Boston.	617,000	....do	....do	......
crew ver- ompound.	15.5	1 6" B. L. R	4 47mm R. C 2 6-pdr. R. F. 2 Gatlings.	315,000	...do	....do	......
rew hori- , triple ex- n.	18.0	12 6" B. L. R	4 6-pdr. R. F 3 37mm R. C. 2 1-pdr. R. F. 4 3-pdr. R. F. 4 Gatlings.	1,248,000	Mar. 3, 1886	Oct. 27, 1887	24
rew hori- al com- l.	18.0	2 8" B. L. R. 6 6" B. L. R.	4 6-pdr. R. F 4 47mm R. C. 2 3-pdr R. F. 2 1 pdr. R. F. 2 Gatlings.	1,017,0.0	Mar. 3, 1885	Dec. 28, 1886	18
rew hori- , triple ex- n.	19.0	4 8" B. L. R. 6 6" B. L. R.	2 Gatlings 4 6-pdr. R. F. 2 3-pdr. R. F. 2 1 pdr. 4 37mm R. C.	1,325,000	Aug. 3, 1886	Dec. 17, 1886	18
....	19.0	12 6" B. L. R.	4 6-pdr. R. F 4 3 pdr. R. F. 2 1-pdr. R. F. 3 37mm R. C. 4 Gatlings.	1,350,000	Mar. 3, 1887	Oct. 27, 1887	24
....	19.0	...do	Same as Philadelphia.	1,428,000	...do	Oct. 26, 1887	24
....	16.0	6 6" B. L. R.	2 Gatlings 2 6-pdr. R. F. 2 3-pdr. R. F. 1 1-pdr. R. F. 2 37mm R. C.	455,000	Mar. 3, 1885	Jan. 31, 1887	12
crew hori- al com- l.	13.0	4 6" B. L. R.	2 3-pdr. R. F 1 1-pdr. R. F. 2 37mm R. C. 2 Gatlings.	247,000	....do	Dec. 22, 1886	12
rew hori- l, triple ex- on.	16.0	Same as No. 1	Same as Yorktown.	490,000	Mar. 3, 1887	Nov. 15, 1887	18
....	16.0	...do	.. do	490,000	...do	...do	18
rew verti- ple expan-	20.0	3 dynamite guns, 15" caliber.	2 3-pdr. R. F. 1 1 pdr. R. F. 2 37mm R. C. 2 Gatlings.	a350,000	Aug. 3, 1886	Feb. 11, 1887	12
rew ver- quadruple nsion.	22.0	8 automobile torpedoes.	2 6-pdr. R. F.	82,750	...do	Mar. 1, 1888	......

a Including dynamite guns, etc.

G.—*Tables of vessels of the*

UNARMORED STEEL AND

Name.	Built.			Condition.	Rig.
	When.	Where.	By whom.		
Ranger	1873–1876	Wilmington, Del	Harlan & Hollingsworth.	Repairing at Mare Island.	Bark
Alert	1873–1875	Chester, Pa	John Roach	Pacific Station	do
Monocacy	1863	Baltimore, Md	A. and W. Denmead & Son.	Asiatic Station	Schooner
Michigan	1844	Erie, Pa	United States	Northwest'n Lakes	Barkentine
Palos	1865	Boston	James Tetlow	Asiatic Station	Schooner
Pinta	1865	Chester, Pa	Reaney, Son & Archbold	Pacific Station	do
Intrepid	1874	Boston	United States	Undergoing alterations, navy-yard, New York; work suspended.	Brig
Alarm	1874	New York	do	In ordinary, New York.	

WOODEN STEAM

Name.	When.	Where.	By whom.	Condition.	Rig.
Trenton	1873–1877	New York	United States	Flag-ship, South Pacific Station.	Ship
Lancaster	1858	Philadelphia	do	Flag-ship, European Station.	do
Brooklyn	1858	New York	Westervelt & Co	On her way to New York.	do
Pensacola	1858–1862	Pensacola	United States	Repairing at Norfolk yard.	do
Hartford	1858	Boston	do	Mare Island in ordinary.	do
Richmond	1858	Norfolk	do	Repairing at New York yard.	do
Ossipee	1861	Kittery	do	Repairing at Norfolk yard.	Bark
Omaha	1867–1869	Philadelphia	do	Asiatic Station	do
Vandalia	1872–1876	Boston	do	Repairing at navy-yard, Mare Island.	do
Juniata	1862	Philadelphia	do	Pacific Station	Ship

*Anthracite.

U. S. Navy—Continued.

IRON VESSELS—Continued.

Dimensions. Length between perpendiculars.	Dimensions. Breadth.	Dimensions. Mean draught.	Dimensions. Displacement in tons.	Indicated horse-power.	Speed in knots.	Batteries. Main.	Batteries. Secondary.	Coal capacity in tons.	Complement. Officers.	Complement. Men.
Feet.	*Ft. In.*	*Feet.*								
175	32 0	12¾	1,020	365	10.0	2 20-pdr. M. L. R.	....	*126	21	127
175	32 0	12¾	1,020	396	10.0	1 XI″ S. B 2 IX″ S. B 1 60-pdr. B. L. R.	1 3″ B. L. R 1 12-pdr. S. B. hwtzr. 1 Gatling. 2 37mm R. C.	*133	21	127
255	35 0	9	1,370	850	11.2	4 8″ S. B. 2 60-pdr. M. L. R.	2 20-pdr. how. R 1 Gatling. 2 24-pdr. S. B. hwtzrs. 2 12-pdr. S. B. hwtzrs. 2 37mm R. C.	†224	12	114
163½	27 1½	9	685	305	10.5	4 30-pdr. B. L. R. 2 3″ B. L. R.	1 3″ B. L. R 2 Gatlings.	*135	......	......
137	26 0	9¾	420	246	10.35	4 24-pdr. S. B. hwtzr. 2 20-pdr. R. howtzrs. 1 12-pdr. howitzer.	1 Gatling 2 37mm R. C. 1 12-pdr. S. B. hwtzr.	*102	9	49
137	26 0	11	306	190	8.5	4 12-pdr. S. B. hwtzrs.	1 Gatling	*111	8	37
170	35 3½	11	1,150	1,812	10.6	....	....	*180	......	......
158½	28 0	10½	800	600	10.0	1 XV″ S. B	....	*40.5	......	......

VESSELS.

Length between perpendiculars (Ft. In.)	Breadth.	Mean draught (Ft. In.)	Displacement in tons.	Indicated horse-power.	Speed in knots.	Batteries. Main.	Batteries. Secondary.	Coal capacity in tons.	Officers.	Men.
253 0	48	20 6	3,900	2,414	12.6	2 20-pdr. B. L. R. 10 8″ M. L. R.	2 3″ B. L. R 1 12-pdr. S. B. hwtzr. 4 47mm R. C.	*337	29	387
235 8	46	19 2	3,250	733	9.6	10 8″ M. L. R.	4 37mm R. C 2 6-pdr. R. F. 1 3″ B. L. R. 1 Gatling.	*288	22	322
233 4	42	19 6	3,000	1,116	10	12 IX″ S. B 1 8″ M. L. R. 1 60-pdr. B. L. R.	4 37mm R. C 2 20-pdr. B. L. R. 1 12-pdr. S. B. hwtzr. 1 Gatling. 1 3″ B. L. R.	†330	23	268
230 8	44½	18 7	3,000	680	9	12 IX″ S. B 2 80-pdr. B. L. R. 2 60-pdr. B. L. R.	1 Gatling. 1 3″ B. L. R.	*285	36	351
225 0	44	18 6	2,900	1,024	9	12 IX″ S. B 1 8″ M. L. R. 1 60-pdr. B. L. R.	2 20-pdr. B. L. R 2 3″ B. L. R. 2 Gatling.	*240	32	285
225 0	42½	17 4½	2,700	692	9.5	12 IX″ S. B 1 8″ M. L. R. 1 60-pdr. B. L. R.	2 20-pdr. B. L. R 4 37mm R. C. 1 3″ B. L. R. 1 Gatling. 2 12-pdr. S. B. hwtzrs.	*265	29	321
205 0	38	16 6	1,900	715	10.5	6 IX″ S. B 1 8″ M. L. R. 1 60-pdr. B. L. R.	2 12-pdr. S. B. hwtzrs. 1 3″ B. L. R. 1 Gatling.	*235	20	194
250 6	38	16 6	2,400	953	11.3	10 IX″ S. B 1 VIII″ M. L. R. 1 60-pdr. B. L. R.	4 37mm R. C 2 20-pdr. B. L. R. 1 3″ B. L. R. 1 Gatling.	*150	22	269
216 0	39	17 3	2,100	1,147	12	6 IX″ S. B 1 8″ M. L. R. 1 60-pdr. B. L. R.	1 3″ B. L. R. 1 12-pdr. S. B. hwtzr. 2 20-pdr. B. L. R. 2 Gatling.	*180	27	184
205 0	38	16 6	1,900	494	8.8	6 IX″ S. B 1 8″ M. L. R. 1 60-pdr. B. L. R.	1 3″ B. L. R 1 12-pdr. S. B. hwtzr. 2 20-pdr. B. L. R. 1 Gatling.	*220	21	179

† Bituminous.

G.—*Tables of vessels of the*

WOODEN STEAM

Name.	Built. When.	Built. Where.	Built. By whom.	Condition.	Rig.
Quinnebaug	1871-1877	Philadelphia	United States	European Station	Ship
Swatara	1872	New York	...do	South Atlantic	...do
Galena	1871-1878	Norfolk	...do	Repairing at New York.	...do
Marion	1871-187	Kittery	...do	Asiatic Station	Bark
Mohican	1872-1883	Mare Island	...do	Repairing at Mare Island.	...do
Iroquois	1858	New York	...do	...do	Ship
Kearsarge	1861	Kittery	...do	Repairing, navy-yard, Portsmouth, N. H.	Bark
Adams	1874-1876	Boston	Donald McKay and United States.	Pacific Station	...do
Alliance	1873-1876	Norfolk	United States	South Atlantic Station	Bark
Essex	1874-1876	Kittery and Boston	Donald McKay and United States.	Asiatic Station	...do
Enterprise	1873-1876	Kittery	John W. Griffiths and United States.	European Station	...do
Nipsic	1873-1879	Washington	United States	Asiatic Station	Bark
Tallapoosa	1874	Baltimore	C. W. Booz & Bro.	South Atlantic Station	Schooner
Yantic	1864	Philadelphia	United States	Repairing at New York navy-yard.	Bark
Despatch	1874		Purchased from Henry C. Smith, N. Y.	Special service	Schooner
Franklin	1855-1865	Kittery	United States	Receiving ship, Norfolk, Va.	Ship
Wabash	1854	Philadelphia	...do	Receiving ship, Boston.	...do
Minnesota	1855	Washington	...do	Receiving ship for boys, New York.	...do

S. Navy—Continued.

SSELS—Continued.

Dimensions.				Indicated horse-power.	Speed in knots.	Batteries.		Coal capacity in tons.	Complement.	
perpendiculars.	Breadth.	Mean draught.	Displacement in tons.			Main.	Secondary.		Officers.	Men.
In.	*Feet.*	*Ft. In.*								
0	37	16 6	1,900	964	10.5	6 IX" S. B......... 1 8" M. L. R. 1 60-pdr. B. L. R.	1 3" B. L. R .... 1 12-pdr. S.B. howtzr.	*180	19	176
0	37	16 6	1,900	680	10.1	6 IX" M. L. S. B.... 1 8" M. L. R. 1 60 pdr. B. L. R.	1 3" B. L. R .... 1 12-pdr. S-B. howtzr. 2 20-pdr. B. L. R. 1 Gatling.	*186	26	188
0	37	16 6	1,900	776	9.5	6 IX" S. B......... 1 8" M. L. R. 1 60-pdr. B. L. R.	1 3" B. L. R......... 2 20-pdr B. L. R. 1 12-pdr. S.B. howtzr. 1 Gatling.	*170	24	190
0	37	16 6	1,900	753	11.25	6 IX" S. B......... 1 8" M. L. R. 1 60-pdr. B. L. R.	1 3" B. L. R .... 2 12-pdr. S. B. hwtzr. 1 Gatling.	*135	18	176
	38	16 6	1,900	613	10.65	1 8" rifle............. 6 IX" S. B. 1 60-pdr.	1 12-pdr. S. B. hwtzr. 2 37mm R. C. 1 3" B. L. R. 1 Gatling.	*162	21	193
0	33⅚	15 3	1,575	1,202	10.7	1 XI" S. B......... 4 IX" S. B. 1 VIII" M. R. 1 30-pdr. M. L. R.	1 12-pdr. S. R. hwtzr. 1 Gatling.	*128	16	176
6	33	15 9	1,550	843	11.1	4 IX" S. B .... 2 8" M. L. R. 1 60-pdr. M. L. R.	1 3" B. L. R .... 1 Gatling.	*165	21	101
	35	14 3	1,375	550	9.8	4 IX" S. B......... 1 8" M. L. R. 1 60-pdr. M. L. R.	1 3" B. L. R......... 1 12-pdr. S. B. hwtzr. 2 37mm R. C. 1 Gatling.	*150	20	16
	35	14 3	1,375	668	9.98	1 60-pdr. B. L. R..... 1 8" M. L. R. 4 IX" S. B.	1 3" B. L. R .... 1 12-pdr. S. B. hwtzr. 1 Gatling.	*150	18	160
	35	14 3	1,375	505	10.4	4 IX" S. B......... 1 8" M. L. R. 1 60-pdr. B. L. R.	1 3" B. L. R. 1 12-pdr. S. B. hwtzr. 1 Gatling.	†130	15	178
	35	14 3	1,375	790	11.4	4 IX" S. B .... 1 8" M. L. R. 1 60-pdr. B. L. R.	2 3" B. L. R .... 1 37mm R. C. 1 Gatling.	†130	18	164
	35	14 3	1,375	839	10.7	1 8" M. L. R .... 4 IX" S. B. 1 60-pdr. B. L. R.	1 3" B. L. R .... 1 Gatling.	*132	23	161
	35	10 0	1,270	872	12.1	1 8" M. L. R .... 5 60-pdrs. M. L. R. 4 12-pdr. howitzer.	1 3" B. L. R .... 1 Gatling. 1 12-pdr. S. B. howitzer.	*201	13	143
	30	12 2	900	225	8.3	2 IX" S. B .... 1 8" M. L. R. 1 60-pdr. B. L. R.	1 3" B. L. R .... 1 Gatling. 1 12-pdr. S. B. hwtzr.	*117	20	134
0	25½	12 4	560	518	12.6	1 3" B. L. R	....	......	6	75
	54¼	24 3	5,170	1,050	9	22 IX" S. B	6 12-pdr. S.B. hwtzrs. 2 20-pdr. B. L. R.....	......	......	......
7	51½	23 0	4,650	950	9.15	18 IX" S. B..........	1 Gatling .... 2 20-pdr. B. L. R.	......	......	......
	51½	23 0	4,700	1,000	9.25	18 IX" S. B......... 1 60-pdr. B. L. R. 2 20-pdrs. B. L. R. P.	2 3" B. L. R .... 1 12-pdr. S. B. hwtzr. 1 Gatling.	......	......	......

*Anthracite. †Bituminous.

G.—*Tables of*

WOC

Name.	Built.		
	When.	Where.	By whom.
Constellation	1854	Gosport	U. S.
Constitution	1797	Boston	U. S.
Independence	1837	....do	U. S.
Monongahela	1862	Philadelphia	U. S.
Portsmouth	1843	Kittery	U. S.
Jamestown	1845	Gosport	U. S.
Saratoga	1842	Kittery	U. S.
St. Louis	1828	Washington	U. S.
St. Mary's	1844	....do	U. S.
Dale	1839	Philadelphia	U. S.

IRON AI

Name.	Built.			Mat
	When.	Where.	By whom.	
Catalpa	1864		Purchased	Wood
Cohasset	1861		....do	....do
Fortune	1865	Boston	James Tetlow	Iron
Leydon	1866	....do	....do	....do
Mayflower	1866	....do	....do	...do
Monterey	1863		Purchased	Wood
Nina	1865	Chester, Pa	Reaney Son & Archbold.	Iron
Rocket	1863		Purchased	Wood
Speedwell	1865	Boston	James Tetlow	Iron
Standish	1865	....do	....do	....do
Triana	1864	New York	William Perine	....do

Navy—Continued.

LS.

lition.	Dimensions.				Batteries.		Complement.	
	Length between perpendiculars.	Breadth.	Mean draught.	Displacement in tons.	Main.	Secondary.	Officers.	Men.
	Ft.	*Ft.*	*Ft.*					
ship, Naval y.	176	42	20	1,186	10 VIII" S. B.......	1 Gatling........... 1 3" B. L. R. 2 20-pdr. B. L. R. 2 12-pdr. S. B. how.	15	203
N. H....	175	45	20	2,200	4 32-pounders S. B..	1 12-pdr. S. B. how.	.....	.....
hip, Mare	189	51½	21½	3,270	6 32-pounders S. B.. 1 60-pounder M. L. R.	1 Gatling..........	.....	.....
, Pacific Sta-	225	38	16½	2,100	2 VIII" S. B........	1 12-pdr. S. B. how..	.....	.....
at Kittery	153	38¾	16½	1,125	11 VIII" S. B....... 1 60-pounder B. L. R.	2 20-pdr. B. L. R..... 1 Gatling. 1 3" B. L. R.	15	210
at Norfolk,	163½	36	16	1,150	12 VIII" S. B.......	2 20-pdr. B. L. R...	17	247
at Kittery	147½	36$\frac{1}{12}$	16	1,025	11 VIII" S. B....... 1 60-pounder B. L. R.	2 20-pdr. B. L. R.... 1 3" B. L. R. 1 Gatling.	18	275
ng ship, Island.	126½	34¾	15½	830	None	None...............	.....	.....
rine School, rk.	150	37½	15½	1,025	8 VIII" S. B......	None...............	.....	.....
ship, Wash- D. C.	117$\frac{7}{12}$	32⅝	14¾	675	8 32-pounders.......	None...............	.....	.....

UG BOATS.

Rig.	Indicated horse-power.	Dimensions.				Speed in knots.	Coal supply.
		Length between perp's.	Breadth.	Mean draught.	Displacement in tons.		
		Ft.	*Ft.*	*Ft.*			
....	....	....	....	....	....	....	....
....	....	97	19½	6½	188	....	....
....	340	137	26	9½	450	10.	80
....	340	137	26	9½	450	10.	80
....	338	137	26	9½	450	10.6	80
....	340	....	....	....	....	8.5	....
....	340	137	26	8½	357	10.	80
....	147	85¾	18¾	7	187	8.5	....
....	340	137	26	9½	450	10.	80
....	340	137	26	9½	450	10.	80
....	340	137	26	9½	450	10.	80

The following vessels have been condemned and sold up to June 3
1888:

Name.	Amou receiv
Cayane	$(
Powhatan	1(
Ticonderoga	1:
Lackawanna	1(
Wachusett	1(

Payments made on account vessels building under contracts under appropriation crease of Navy," up to and including October 31, 1888.

Vessels.	No. of pay-ments.	Amo pai
Yorktown	9	$3(
Baltimore	8	9:
Philadelphia	3	3(
Newark	1	1]
San Francisco	1	1]
Charleston	8	7:
Vesuvius	9	2]
Petrel	6	1:
Concord	3	1:
Bennington	3	1:
Total	....	3,

H.—*Statement of the condition of the various vessels now building for the Navy, under tract, up to October* 1, 1888.

CRUISER No. 2—CHARLESTON.

OFFICE OF NAVAL CONSTRUCTOR SUPERINTENDING
HULLS OF VESSELS FOR U. S. NAVY, UNION IRON WORKS,
San Francisco, Cal., July 25, 18(

SIR: Late last night I telegraphed that the *Charleston* was successfully laun(this evening at 7.40. The exact time was 7.36 p. m. The draught of water, owin the fact that the after packing of the ship is still underneath it, can not be accura obtained. It will be forwarded as soon as possible.

Very respectfully, your obedient servant,

F. L. FERNALD,
Naval Constructor, U. S. N.,
Superintending Hu

Chief Constructor T. D. WILSON, U. S. N.,
Chief of Bureau of Construction and Repair,
Navy Department, Washington, D. C.

OFFICE OF NAVAL CONSTRUCTOR SUPERINTENDING
HULLS OF VESSELS FOR U. S. NAVY, UNION IRON WORKS,
San Francisco, Cal., July 25, 188

SIR: I have to report the draught of water of cruiser No. 2, *Charleston*, to b(follows:

Forward	5 ft. 5
Aft	13 ft. 6½
Mean	9 ft. 5¾

The weight of hull by scales is—

	Tons.
Metal	1,308.58
Wood	2.17
Cement and paint	44.00
Total weight of hull	1,354.75
Machinery	37.22
Grand total by scales	1,391.97
Estimated weights of staging, old material, forgings, etc., on board not belonging to ship	25.00
Estimated displacement	1,416.97

Very respectfully, your obedient servant,

F. L. FERNALD,
Naval Constructor, U. S. N., Superintending Hull.

Chief Constructor T. D. WILSON, U. S. N.,
Chief of Bureau of Construction and Repair,
Navy Department, Washington, D. C.

OFFICE OF NAVAL CONSTRUCTOR SUPERINTENDING
HULLS OF VESSELS FOR U. S. NAVY, UNION IRON WORKS,
San Francisco, October 4, 1888.

SIR: I have the honor to report the condition of the work on the hull of cruiser No. 2, *Charleston*, on the 1st inst. to be as follows:

EXTERIOR.

The exterior of the vessel, below upper deck, is completed, except securing ash-chutes, side-ladders and sentry-boards; making and securing shutters to torpedo-ports, and grab-rods, sea-steps, carved work around bow and stern, and some minor fittings.

ON AND ABOVE UPPER DECK.

Deck-plating, foundations for 6-inch guns, towing bitts, flag-staffs	Completed.
Bulwarks, hammock-berthing, and deck-houses, forward and aft	80 per cent. completed.
Loading stations	90 per cent. completed.
Barbettes	95 per cent. completed.
All metal work about chart and wheel-house and bridge frames	Completed.
Hotchkiss gun platforms on rail	90 per cent. completed.
Wood hatch coamings	Completed.
Steel hatch coamings	95 per cent. completed.
Conning tower, except a few rivets and trimming sight-holes	Completed.
Troughs for seamen's head, except securing	Completed.
Holes for passing scuttles	Cut.
Fire-room ventilators	80 per cent. completed.
Ventilating scuttles forward and abaft barbettes and in barbettes, with hoods	95 per cent. completed.
Wire hawser stoppers, except riveting to deck	Completed.
Teak decking under 6-inch guns is being prepared on shore and is 30 per cent. finished.	

ON BERTH DECK.

All bulkheads are finished, except the fire-room hatch casing, which is fitted but not riveted. Stanchions, except securing, eight finished. Air-ports and casings, 97 per cent. completed.

Wood deck is laid in cabin and about 50 per cent. of sick bay. Wooden hatch coamings, 80 per cent completed. Ventilating fan in place. Supports for 8-inch guns, including extra strengthening, 98 per cent. completed.

ON PROTECTIVE DECK.

Deck plating, brackets connecting frames to plating, and coal scuttles	Completed.
Bulkheads, supports for 8-inch guns, and coffer-dams	95 per cent. completed.
Water-tight doors and scuttles; battle-hatches to magazines and shell-rooms	96 per cent. completed.
Coal chutes, except calking	Completed.
Tramways in bunkers and coal buckets	90 per cent. completed.
One ventilating fan	Completed.
One torpedo-port casting, with fittings, except riveting	Completed.
Holes for other torpedo-ports	Cut.
Air-ports in torpedo chambers	Completed.
Holes for air-duct pipes	30 per cent. cut.
Automatic valves for air-ducts	60 per cent. completed.
Glacis plates around fire-room hatch	80 per cent. completed.
Drain valves	40 per cent. completed.

ON PLATFORM DECKS.

Bulkheads	Completed.
Kingston valves	Completed.
Water-tight doors	90 per cent. completed.
Ammunition-room light-boxes	80 per cent. completed.
Drain-valves	80 per cent. completed.

IN HOLD.

Bulkheads, except that between boiler-rooms, which has been removed to admit boilers	Completed.
All machinery seatings	Completed.
Boiler-saddles, except riveting to foundations	Completed.
Water-tight doors	90 per cent. completed.
Kingston valves	Completed.
Drainage system	98 per cent. completed.
Metal work in ammunition-rooms, including flooding and drainage fittings	98 per cent. completed.
Water bottom, except air and sounding pipes	Completed.
Ammunition tubes	80 per cent. completed.
Hydraulic steering gear is completed, except fittings for wheel ropes, which are	60 per cent. completed.
A large number of places where water would lie has been cemented. Ship throughout has been primed where work would permit	Painting deferred, as the weather is dry.

FORGED WORK.

Fittings for accommodation ladders, awning stanchions, guard-rail stanchions, riding bolts for securing anchors, and numerous eye and ring bolts for general service; pump standards and fittings, including cranks for fly wheels, etc., stanchions for standard compass platforms, anchor davits, fittings for mess tables and seats, for Hotchkiss gun platforms; hinges and eye bolts for torpedo shutters; hinges for loading-station doors	All completed.
Boat davits	50 per cent. completed.
Fittings for light boxes in ammunition rooms	95 per cent. completed.

BRASS WORK.

Supporting and guard-rail stanchions for search-light and standard-compass, platforms, rails and stanchions for bridges	Completed.
Hand pumps	90 per cent. completed.
Canopy frames	95 per cent. completed.
Fittings for sluice-valves, plug-cocks, ventilator registers, pedestals, and hand-wheels for steerer	95 per cent. completed.
Skylight and ladders	98 per cent. completed.

JOINER WORK.

Accommodation and deck ladders	90 per cent. completed.
Skylights	Completed.
Veneered work	20 per cent. completed.
Of which	60 per cent. is polished.
Other bulkhead work	15 per cent. completed.

MISCELLANEOUS.

Galvanized iron air ducts	15 per cent. completed.
Hydraulic pumping apparatus	85 per cent. completed.

Castings for one electric-light engine out of sand.

Very respectfully, your obedient servant,

F. L. FERNALD,
Naval Constructor, U. S. N.,
Superintending hull.

ARMORED CRUSIER—MAINE.

COMMANDANT'S OFFICE,
Navy-yard, New York, October 3, 1888.

SIR: In reply to the Bureau's letter of the 1st instant No. 3001, requesting a statement of material received and work done on the *Maine*, I have the honor to report as follows up to October 1, 1888:

	Pounds.
Material received, steel:	
1,653 plates	943,106
108,936 rivets	63,418
722 angles	146,400

The casting of the lower stem is finished, although not delivered, the estimated weight about 18,000 pounds. The work completed is:

Main frame angles, bent		80
Main keel plates ready except bending	feet..	200
Inner keel plates ready	do...	120
Vertical keel plates ready	do ..	180
All the keel plates are rolled.		
Floor plates rolled		20
Keel plates pickled		46
Floor plates pickled		364
One-half staples finished		18
One-half staples nearly finished		60

Molds nine-tenths completed.
Working plans seven-tenths completed.
Keel-blocks laid.

The contract for the steel to be used in the construction of this cruiser was signed June 15, and was made with Messrs. Carnegie, Phipps & Co. (Limited), of Pittsburgh, Pa.

The first shipment of plates was July 20, and since then the delivery has been steadily going on. The first shipment of angles was August 17, the first shipment of rivets August 31. The pickling of the plates was commenced the middle of August; the machining of plates August 29, in the iron-platers shop, where the work was being done for the remainder of ships at the yard. When the improved tools are ready the work will be pushed as rapidly as possible.

The first frame was bent September 10.

On the 29th of September 111 men were employed on the ship.

Respectfully,

BANCROFT GHERARDI,
Rear-Admiral, U. S. N., Commandant.

Chief Constructor T. D. WILSON, U. S. N.,
Chief of the Bureau of Construction and Repair,
Navy Department, Washington, D. C.

DOUBLE TURRETED MONITOR—MIANTONOMOH.

Report forwarded by Commandant of the navy-yard, New York, showing the work necessary to complete the Miantonomoh, October 4, 1888.

Hurricane deck	To complete.
Thirteen water-tight doors to be made with fittings complete for bulkheads in forward and aft holds	Eight-tenths completed.
Four covers to be made with all fittings complete for light holes in forward and after magazines and shell-rooms	Seven-tenths completed.
Covers to be made for seven hatches with all fittings complete in forward and after holds	Seven-tenths done.
Water-tight trunks to be fitted to hurricane deck around engine and fire-room hatches on main deck	Nine-tenths completed.
Strainers to be made for drain wells in engine-room for turret engines	One-half completed.
Ventilators for state-rooms, in forward and after holds underneath main-deck beams to be connected with blowers.	Not commenced.
Ventilator pipes leading from blowers through coal bunkers and fire-rooms to ventilators on deck	Not commenced.
Sea-cocks to be ground and all pumping system to be overhauled and replaced	Not commenced.
To repair the main deck and plank sheer, which are thoroughly defective	Not commenced.
New 8-inch main drains of galvanized iron pipe	Not commenced.
Three-inch suction to inner and lower bottoms and fire-mains and discharge-pipes	Not commenced.
Eight-inch and 3-inch globe valves for suction and fire mains	Not commenced.
Two 7-inch pumps for bilge and fire pumps	Not commenced.
One fresh-water pump for galley put up and connect	Not commenced.
Lining beds of blower and turret engine	Not commenced.
Repairs to officers' and crews' water-closets and air-pumps.	Five-tenths completed.
Making and connecting air-pipes on berth deck and in rooms	Four-tenths completed.
Relining magazine shell-rooms, sail-rooms, and bread-rooms.	Not commenced.
Lockers for master-at-arms, cap and musket racks for marines.	Not commenced.
Prisons to be built, ladders to bread-room, paymaster's and ordnance store-rooms to be finished	Nine-tenths completed.
All store-rooms, magazines, and shell-rooms to be painted two coats	One-tenth completed.
Orlop deck two coats; engine-room, fire-room, and coal bunkers two coats	Five-tenths completed.
Cabin, wardroom, and steerage three coats	Not commenced.
Berth deck three coats, and calked overhead	Not commenced.
Turrets three coats	Four-tenths completed.
Bridges three coats; all work on spar-deck two coats	Not commenced.
Military mast to be fitted and placed in position	Nine-tenths completed.
Top-mast, fore-mast, and boat spars to make	Five-tenths completed.
Sailing launch requires slight repairs	Nine-tenths completed.
Fourth cutter and gig require awning stanchions, flag-staffs, back-boards, rudder, and to be calked	Nine-tenths completed

WORK TO BE COMPLETED ON FORWARD TURRET.

Putting armor of turret together on deck	Not commenced.
Fitting and riveting plating forming inner lining of turrets.	Eight-tenths completed.
Guard-plates inside of turrets to be riveted, fitted and tapped in place, and patches to be fitted and riveted on guard-plate back of armor-bolts	Eight-tenths completed.
Beam-shelf inside of turret on top of guard-plate to be fitted, riveted, and tapped	Eight-tenths completed.
Bulk-head in center of turret to be fitted and riveted, with doors and all fittings complete	Not commenced.
Beams to form top of turret to be fitted	Not commenced.
Steel plating on top of turret to be rolled, punched, countersunk, flanged, and riveted in place to beams of turrets	Not commenced.
Outside lapped course of plating to be riveted	One-half completed.
Steel castings to be fitted and bolted under gun-carriages	One-half completed.
vertical frame to be fitted to side of turret	Not commenced.
mor-shelf and knees to be fitted to side of turret	Nine-tenths completed.

Condemned rolls to be taken out and replaced with new ones	Three-tenths completed.
Armor to be placed in position on turret	Not commenced.
Port-holes to be trimmed, sleeve fitted and riveted only in shell	Not commenced.
Port-holes in armor to be enlarged and recessed to receive sleeves	Not commenced.
Holes to be drilled in turrets for armor-bolts and bolts to be placed in position to screw-armor	Not commenced.
Cast-steel angle underneath armor on armor-shelf	Not commenced.
Armored pilot-house on top of turret to be put in place and alterations to sighting-holes as may be required	Not completed.
Cast-steel column in center of turret underneath pilot-house.	Eight-tenths completed.
Glacis-plate to be put on top of turret around pilot-house	Not commenced.
Holes in top of armor to be drilled and tapped to place armor in position of turret	Not commenced.
Glacis-plate to be drilled and riveted in place on board ship.	Nine-tenths completed.

WORK TO BE COMPLETED ON AFTER TURRET.

Guard-plate inside of turret to be riveted and tapped in places	Nine-tenths completed.
Beam-shelf on top of turret inside to be riveted and tapped.	Nine-tenths completed.
Port-holes in armor to be enlarged and recessed to receive sleeve	Not commenced.
Armor to be placed in position on turret	Not commenced.
Holes to be drilled in turret for armor-bolts, and bolts to be placed in position to secure armor	Not commenced.
Bulk-head in center of turret to be fitted and riveted, with doors and all fittings complete	One-tenth completed.
Steel castings to be fitted and bolted in pockets underneath gun-carriages fitted; outside tapered course of plating to be riveted	Five-tenths completed.
Beams to form top of turret to be fitted	Not commenced.
Steel plating on top of turret to be rolled, punched, countersunk, flanged, and riveted to beams in place on turret	Not commenced.
Armor-shelf and knees to be riveted and fitted to side of turret	Seven-tenths completed.
Glacis-plate on top of turret to be placed around pilot-house armor	Not commenced.
One 2-inch steel-plate to be fitted on top of pilot-house armor.	Not commenced.
Cast-steel column in center of turret to be secured to inner skin of ship	Eight-tenths completed.
Securing cast-steel angle underneath armor on armor-shelf.	Not commenced.
Holes in top of armor to be drilled and tapped to place armor in position on turret; holes to be drilled on main-deck around turret to secure glacis-plate	Not commenced.
Glacis-plate to be drilled and riveted in place on board ship.	Eight-tenths completed.
Bomb-proof grating to be made and placed in position in smoke-stack	Six-tenths completed.
1 side-board	Not commenced.
14 wash-stands	Not commenced.
20 towel racks	Not commenced.
8 toilet racks	Not commenced.
4 dining tables	Two completed.
4 transom cushions	Two completed.
1 sofa	Not commenced.
1 shipwriter's desk	Not commenced.
1 yeoman's and 1 sergeant's desk	Not commenced.
Mess benches and tables	Not commenced.
8 snatch-blocks	Not commenced.
28 blocks for boat sails	Not commenced.
8 cat and fish blocks	Not commenced.
Overhaul and replace steering gear	Not commenced.
20 vinegar and molasses kegs	Not commenced.

Estimated cost to complete above work:

Labor on hull and turrets	$77,100
Material on hull and turrets	7,800
	84,900

Time required to complete the same, four months.

Respectfully, your obedient servant.

JOHN B. HOOVER,
Assistant Naval Constructor, U. S. Navy.

DYNAMITE GUN CRUISER—VESUVIUS.

OFFICE OF INSPECTOR OF HULLS FOR U.S. NAVY,
WM. CRAMP & SONS SHIP AND ENGINE BUILDING WORKS,
Philadelphia, Pa., April 28, 1888.

SIR: I have to respectfully inform the Bureau that the dynamite-gun cruiser was this day launched from the yard of the builders, William Cramp & Sons Ship and Engine Building Company, Philadelphia.

Very respectfully, your obedient servant,

JOHN B. HOOVER,
Assistant Naval Constructor, U. S. Navy, Superintending Constructor.

Chief Constructor T. D. WILSON, U. S. Navy,
Chief of Bureau of Construction and Repair, Navy Department, Washington, D. C.

OFFICE OF INSPECTOR OF HULLS FOR U. S. NAVY,
WM. CRAMP & SONS SHIP AND ENGINE BUILDING WORKS,
Philadelphia, Pa., May 12, 1888.

SIR: I have to respectfully inform the Bureau of the launching draught of the dynamite-gun cruiser *Vesuvius*, the displacement in fresh water, and also weights of ship as reported to the date of launching, April 28:

	Ft.	In.
Draught forward	6	2¼
Draught aft	4	6

		Tons
Displacement (from scale)		313.76
Extra material and men on board at time draught was taken, not belonging to ship		9.38
Actual weight of ship by displacement		304.38
Weights reported to April 1 ... pounds	602,115	
Weights placed on board since last report to date of launching ... do	63,463	
Total weight in pounds	665,578	297.13
Difference of weights by displacement and by weights reported		7.25
Tons per inch of immersion at this line of flotation		8.17

Very respectfully, your obedient servant,

JOHN B. HOOVER,
Assistant Naval Constructor, U. S. Navy, Superintending Constructor.

Chief Constructor T. D. WILSON, U. S. Navy,
Chief of Bureau of Construction and Repair, Navy Department, Washington, D. C.

OFFICE OF INSPECTOR OF HULLS FOR U. S. NAVY,
WM. CRAMP & SONS, SHIP AND ENGINE BUILDING COMPANY,
Philadelphia, Pa., October 4, 1888.

SIR:—Herewith is submitted report of progress of work upon the hull of the U. S. dynamite gun cruiser *Vesuvius*, at these works during the months of August and September, 1888:

Items.	Condition.	Required to complete.
Deck plank	Completed except forward on berth deck, where it is left off around guns and near foundation of conning tower.	One-tenth.
Skylights	Completed	
Forced draught in fire room	do	
Drainage	do	
Pumps	do	
Anchor davits	do	
Boat davits	do	
Awning stanchions	do	
Guard rail and stanchions	do	
Joiners' work	Completed, except easing doors, hatch covers, and incidental work.	Do.
Conning tower	All plates and angles bolted in place. Shutters and platform on forecastle deck not finished.	Five-tenths.
Steering apparatus	Completed, except wheel and fittings in conning tower.	Three-tenths.
Painting	The ward-room, cabin and inside of deck have received two coats of white paint, forward rooms on berth deck one coat of white and require finishing coat. Outside ready for final coat of black.	One-tenth.
Speaking tube and telegraph	Tube in place and connections being made. Telegraph wires being led and fittings on hand.	Four-tenths.
Electric call bells	Wires being led and fittings on hand	Do.

Items previously reported finished are omitted herefrom.
Total weights placed in hull, 1,376,060 pounds (614$\frac{700}{2240}$ tons).
Very respectfully, your obedient servant,

J. F. HANSCOM,
Assistant Naval Constructor, U. S. N,
Superintending Constructor.

Chief Constructor T. D. WILSON, U. S. N.,
Chief of Bureau of Construction and Repair,
Navy Department, Washington, D. C.

GUNBOAT NO. 1—YORKTOWN.

OFFICE OF INSPECTOR OF HULLS FOR U. S. NAVY,
WM. CRAMP & SONS, SHIP AND ENGINE BUILDING WORKS,
Philadelphia, Pa., April 28, 1888.

SIR: I have to respectfully inform the Bureau that the U. S. S. *Yorktown* (gunboat No. 1) was this day launched at the yard of the contractors, The Wm. Cramp & Sons Ship and Engine Building Company, Philadelphia.
Very respectfully, your obedient servant,

JOHN B. HOOVER,
Assistant Naval Constructor, U. S. N.,
Superintending Constructor.

Chief Constructor T. D. WILSON, U. S. N.,
Chief of Bureau of Construction and Repair,
Navy Department, Washington, D. C.

OFFICE OF INSPECTOR OF HULLS FOR U. S. NAVY,
WM. CRAMP & SONS, SHIP AND ENGINE BUILDING WORKS,
Philadelphia, Pa., May 12, 1888.

SIR: I have to respectfully inform the Bureau of the launching draught of the U. S. S. *Yorktown* (gunboat No. 1), the displacement in fresh water, and also weight of ship as reported to the date of launching, April 28:

Draught forward		4 ft. $\frac{3}{8}$ in.
Draught aft		9 ft. $3\frac{1}{4}$ in.
		Tons.
Displacement (from scale)		591.47
Extra material and men on board at time draught was taken not belonging to hull		18.34
Actual weight of ship per displacement scale		573.13
Weights reported to April 1	1,139,899	
Weights put on board since last report to date of launching	121,627	
Total weight in pounds	1,261,526	563.18
Difference of weights by displacement and by weights reported		9.95
Tons per inch of immersion at this line of flotation		10.83

Very respectfully, your obedient servant,

JOHN B. HOOVER,
Assistant Naval Constructor, U. S. N.,
Superintending Constructor.

Chief Constructor T. D. WILSON, U. S. N.,
Chief of Bureau of Construction and Repair,
Navy Department, Washington, D. C.

OFFICE OF INSPECTOR OF HULLS FOR U. S. NAVY,
WM. CRAMP AND SONS, SHIP AND ENGINE BUILDING COMPANY,
Philadelphia, Pa., October 10, 1888.

SIR: Herewith is submitted report of progress of work upon the hull of the U. S. gunboat No. 1, *Yorktown*, at these works, during the months of August and September, 1888:

Items.	Condition.	Required to complete.
Coal bunker and other fore and aft bulkheads.	Completed except doors, which are being fitted.	One-tenth.
Water-tight doors	Completed except those in transverse coal bunker bulkheads and clamps.	Three-tenths.
Holes in bulkheads, for engineers' pipes.	Holes for piping dynamo engine to be cut	One-tenth.
Hammock berthings	Eye bolts, etc., to be put in place	Do.
Freeing ports	Completed except shutters, not made	Three-tenths.
Machine gun and torpedo port shutters.	Completed except shutters, now being fitted	Two-tenths.
Torpedo arrangements	Forward and after secured in place; others in place not riveted.	Five-tenths.
Platforms for guns	On poop and forecastle decks, plank laid ready for tracks and castings. Others under way.	Seven-tenths.
Gun supports	Completed	
Hammock hooks	Completed forward, required in cabin	One-tenth.
Hatch coamings and skylights	Coamings completed. One skylight to fit, two sashes to hang.	Do.
Grating, and hatch covers	Steel covers completed. Bars fitted and gratings being made.	Do.
Air ports	Completed, except lanyards, etc	One-tenth.
Ladders (side) sea-steps, etc	Ready for shop fittings. Sea-steps not on hand.	Four-tenths.
Awning stanchions	Sockets secured in place	Nine-tenths.
Guard rail and stanchions	Stanchions all in place. Rail not fitted	Five-tenths.
Canopies	Being fitted in shop. Material on hand to complete.	Nine-tenths.
Iron rounds or ladders	Completed in coal bunkers	One-tenth.
Ladders to hatchways, etc	For poop and forecastle decks ready for fitting. For hatchways nearly ready.	Six-tenths.
Hatch cranes	Material on hand, not commenced	

Items.	Condition.	Required to complete.
Shot-racks and musket-racks	Material on hand, not commenced	
Attachments for rigging chain-plates, bolts.	Completed	
Lashing bolts and shackles for securing guns.	Finished in shop	Five-tenths.
Chocks for fair-leaders	Being fitted	Do.
Pin rails	Completed except brass castings for fronts and ends.	Three-tenths.
Lumber irons	Material on hand, not commenced	
Life buoy guards	do	
Brass rubbing plates	do	
Jacob's ladders	Fittings for, completed	
Running lights	Fittings for, not commenced	
Swinging booms	Completed	
Ensign staff	Fittings completed	
Deck lights	Completed except cocks for drainage	Two-tenths.
Watch bell	Ready for hanging	Three-tenths.
Boat davits and cradles	Davits completed and in place. Backing chain hooks riveted in place. Lovers, etc., not ready; cradles about half finished.	Four-tenths.
Galley house, bed, etc	Completed except air-ports	One-tenth.
Cofferdams	Completed except brass frames and covers around forward fire-room enclosure.	Do.
Bow stoppers	Castings received, not in place	Nine-tenths.
Hawse pipes	Doubling plates, inside, secured in place; holes recut; pipes not cast.	Eight-tenths.
Windlass and capstan	Completed	
Ring bolts in deck	do	
Anchor davits	Completed; approved alterations to be made	One-tenth.
Bill-boards	Material on hand, being templated off	Nine-tenths.
Conning tower shield, etc	All plates finished and riveted; top ready to put in place; shield completed.	Two-tenths.
Wooden pilot-house	Completed on board; speaking-tube, engine-room, telegraph and tell-tale from rudder being fitted; gratings to be made.	Two-tenths.
Steering apparatus	Being placed in ship; beveled wheel and shaft connected with stand under poop; stuffing boxes and tubes in place through bulkheads as far as No. 97; steering wheels and wire rope from engine to conning tower not received; other fittings on hand.	Three-tenths.
Water-tanks	Tanks completed; connections about three-fourths finished.	Three-tenths.
Ash chutes	Being fitted in ship; covers and gratings not finished.	Three-tenths.
Trunks to coal bunkers	Completed except door fastenings	Two-tenths.
Magazines	Overflows. Outlets and flood-cocks in place. Rods and deck-plates being finished in shop. Other fittings not ready.	Three-tenths.
Passing scuttles	Completed except covers, which are being finished.	Seven-tenths.
Shell-rooms	Water-tight covers finished. Trunks ready for lining. Fittings commenced.	Four-tenths.
Fixed-ammunition room	Completed except fittings, which are not ready.	Three-tenths.
Torpedo room and torpedo magazine.	Completed except fittings, which are not ready.	Three-tenths.
Ventilation	Portion of piping in coal-bunkers completed. Castings and brass louvres in hammock berthings fitted in place. Pipes for main ducts, etc., being delivered.	Eight-tenths.
Forced draught in fire-rooms	Completed except hatch-covers and air-locks	Two-tenths.
Pumping arrangements	All pumps, sea-valves, and strainer boxes in place, and about one-fourth the connections made. Fire and main pipe nearly completed. Ludlow valves and other fittings on hand to complete.	Seven-tenths.
Sluice-valves, pipes, etc	Flushing-valves in bilges all in place. Four strainer boxes in place and connected to pipes. Sluice-valves all in position. Lifting-rods, deck-plates, socket-levers, screws, etc., on hand to complete.	Five-tenths.
Sounding-tubes	Tubes all in place. Deck plates, etc., not finished.	Five-tenths.
Speaking-tubes and telegraph	Tubes in place in passage-way. Starboard connections partly made. Annunciator for mechanical telegraph in place in engine-room. Holes drilled in bulkheads leading to conning tower and chart-house. Material to complete on hand.	Seven-tenths.
Ceilings in hold and store-room	Completed on berth deck forward except forward of bulkhead No. 7, which is left off to facilitate work on hawse pipes. On main deck, about one-fourth in place. Material on hand to complete.	Eight-tenths.

Items.	Condition.	Required to complete.
Wardroom	Completed ready for furniture, except venetian and stationary blinds and locks for lockers.	Two-tenths.
Steerage	Lockers, transoms, etc., completed, except locks, etc.	Two-tenths.
Cabins under poop deck	Sections for wardroom skylight bulkhead in place. Captain's state-room, bath-room, and water-closet, completed except painting.	One-tenth.
Sail-room	Gratings fitted; battens in place; rollers not ready.	One-tenth.
General and other store-rooms	Completed, except wire-screen panels not received.	Two-tenths.
Paymaster's office	Ready for painting	One-tenth.
Armory	Material on hand; fittings not received	One-tenth.
Prison	All angles and plates in place, except after plate kept off to facilitate work on torpedo-tubes.	Four-tenths.
Master-at-arms locker	Material on hand; not commenced	
Signal lockers	Material on hand; not commenced	
Rudder mold	Material on hand; not commenced	
Dispensary	Completed	
Engineer's workshop	Completed, except benches, etc	One-tenth.
Engineer's store-room	Completed	
Pantries	Completed, except hooks, etc	Two-tenths.
Water-closets	Fixtures received. Completed aft and only a few connections required to finish those forward.	Two-tenths.
Firemen's wash-room	Nearly finished; material on hand	Three-tenths.
Lavatories for officers and crew	For officers, about one-half finished; basins, etc., being fitted; for crew completed, except plugs, chains, etc., for basins.	Three-tenths.
Reels	Received; not yet fitted in place	Nine-tenths.
Brass label-plates	Not received	
Mess and clothes lockers for crew.	About one-half received and fitted in place	Nine-tenths.
Lamp-room	Shelving and lockers not fitted	
Oil-tanks	Material on hand; not commenced	
Scuppers	Completed	
Electric call bells	Holes made for lead through bulkheads; material on hand to complete	Eight-tenths.
Electric lighting apparatus	Joiners' work being put in place	Nine-tenths.
Swinging tables and benches for crew.	Received	One-tenth.
Painting	Inside; wardroom primed; water-ways and chocks on forecastle deck have received second coat; forward magazine, shell-rooms, store-rooms, sail-rooms, water-closets, wash-rooms, etc., have been cork painted; outside, all cemented and ready for final coat of black.	Three-tenths.
Cement	Completed	

Items previously reported completed are omitted herefrom.
Total weights placed in hull, 2,278,818 pounds (1017 $\frac{778}{2240}$ tons).

Very respectfully, your obedient servant,

J. F. HANSCOM,
Assistant Naval Constructor, U. S. N., Superintending Constructor.

Chief Constructor T. D. WILSON, U. S. N.,
Chief of Bureau of Construction and Repair,
Navy Department, Washington, D. C.

STEEL CRUISER—CHICAGO.

Report forwarded by commandant of the navy-yard, New York, showing the work necessary to complete the Chicago, October 5, 1888.

In obedience to the Bureau's order of 29th ultimo, No. 2963, asking for a detailed statement of what work remains to be done on the *Chicago*, under the cognizance of the Bureau, to complete the vessel, with an estimate of the time and cost involved, etc., I have the honor to report that the following work remains to be completed: Machine-gun fittings; gun circles to secure to; life-buoy locks to fit; docking ship; painting to complete; silverware to stow; speaking-tubes to anchor engine; brass rail around steering-engine; tramways for projectile; drainage to fire-room; drainage to crank pits; hose pipes to stow; equipment, ordnance, and navigation stores to stow; eye-bolts for pendants on masts; hammock number to secure; eight boat fall blocks; four snatch-blocks; four cabin and three steerage cushions; fire-room hatch in-

closures; steel hawser reel to stow; scuppers to bridge; carbine-boxes to stow; eye-bolts for ladders.

Estimated cost for labor	$7,560
Estimated cost for material	2,000
Total	9,560

Estimate of time to complete the above work, forty days.

Respectfully, your obedient servant,

JOHN B. HOOVER,
Assistant Naval Constructor, U. S. N

GUNBOAT No. 4—BENNINGTON

OFFICE OF SUPERINTENDING CONSTRUCTOR,
DELAWARE RIVER IRON WORKS,
Chester, Pa., October 5, 1888.

SIR: I herewith submit the following report of progress of work upon the hull of gunboat No. 4, *Bennington*, building at these works, during the month of September, 1888.

Items.	Condition.	Degree of completion.
Mold-loft	Making molds	Nine-tenths.
Keels	Working outer keel	Do.
	Erecting outer keel	Do.
	Working inner keel	Do.
	Erecting inner keel	Do.
Center keelson	Erecting plates	Do.
Staging and platforms	Erecting	Seven-tenths.
Floor-plates	Working	Nine-tenths.
Stem	...do	Do.
Stern-post	...do	Completed.
	Erecting	Do.
Frames	Working 6-inch Z bars	Nine-tenths.
	Working 5-inch Z bars, at ends	Five-tenths.
	Working reverse frames	Nine-tenths.
	Erecting 6-inch frames	Do.
Hull plating	Working "B" strake	Five-tenths.
	Erecting "B" strake	Three-tenths.
	Working "D" strake	Two-tenths.
	Erecting "D" strake	Do.
Longitudinal	Working first	Four-tenths.
	Erecting first	Three-tenths.
	Working first longitudinal rider plates	Five-tenths.
	Working main-deck beams	Two-tenths.
	Working boat davits amidships	One-tenth.
	Working boat davit fittings amidships	Do.
	Working deck mooring bitts (brass)	Eight-tenths.
	Working coal scuttles	Two-tenths.
	Working rail stanchions on poop-deck	Six-tenths.
	Working rail stanchions on forecastle deck	One-tenth.
	Working stanchions to poop and forecastle	Do.

Total finished weights put in hull of *Bennington* up to October 1, 1888, 109,003 pounds (48.662 tons).

Very respectfully, your obedient servant,

R. W. STEELE,
Naval Constructor, U. S. N.,
Superintending Constructor.

Chief Constructor T. D. WILSON, U. S. N.,
Chief of Bureau of Construction and Repair,
Navy Department, Washington, D. C.

GUNBOAT No. 3—CONCORD.

OFFICE OF SUPERINTENDING CONSTRUCTOR,
DELAWARE RIVER IRON WORKS,
Chester, Pa., October 5, 1888.

SIR: I herewith submit the following report of progress of work upon the hull of Gun-boat No. 3, *Concord*, building at these works, during the month of September, 1888.

Items.	Condition.	Degree of completion.
Mold loft	Making molds	Nine-tenths.
Keels	Working outer plates	Completed.
	Erecting outer plates	Do.
	Working inner plates	Do.
	Erecting inner plates	Do.
Center keelson	Erecting plates	Do.
Staging and platforms	Erecting	Seven-tenths.
Floor plates	Working	Nine-tenths.
Stem	Erecting	Completed.
	Working	Do.
Stern-post	...do	Do.
	Erecting	Do.
Frames	Working 6-inch Z bars	Nine-tenths.
	Working 5-inch Z bars, at ends	Five-tenths.
	Working reverse frames	Nine-tenths.
	Erecting 6-inch frames	Do.
	Erecting 5-inch frames, at ends	Five-tenths.
Longitudinal	Working first	Four-tenths.
	Erecting first	Three-tenths.
	Working first longitudinal rider plates	Five-tenths.
Hull plating	Working "B" strake	Do.
	Erecting "B" strake	Three-tenths.
	Working "D strake	Do.
	Erecting "D" strake	Two-tenths.
	Working main-deck beams	Do.
	Working ward-room joiner work	Four-tenths.
	Working steerage joiner work	Two-tenths.
	Working cabin joiner work	One-tenth.
	Working skylights on poop-deck	Five-tenths.
	Working boat davits amidships	One-tenth.
	Working boat-davit fittings amidships	Do.
	Working deck-mooring bitts (brass)	Eight-tenths.
	Working coaling scuttles	Two-tenths.
	Working rail stanchions on poop deck	Six-tenths.
	Working rail stanchions on forecastle deck	One-tenth.
	Working stanchions to poop and forecastle	Do.

Total finished weights put in hull of *Concord* up to October 1, 1888, 143,144 pounds equal 63.903 tons.

Very respectfully, your obedient servant,

R. W. STEELE,
Naval Constructor, U. S. N.,
Superintending Constructor

Chief Constructor T. D. WILSON, U. S. N.,
Chief of Bureau of Construction and Repair,
Navy Department, Washington, D. C.

DOUBLE TURRETED MONITOR—TERROR.

Report forwarded by the commandant of the navy-yard, New York, showing the condition of work on the Terror October 5, 1888.

In compliance with the bureau's order of the 1st instant, No. 3002, I have the honor to report that the following work has been commenced on the *Terror*: Cutting out and removing turret rings, bulkheads, beams, and armor deck, incurred in alterations for new turrets.

Respectfully, your obedient servant,

JOHN B. HOOVER,
Assistant Naval Constructor, U. S. N.

NOTE.—The plans for the *Terror* have been fully made and the specifications prepared in detail.

Schedule of material under the several classes have been prepared and printed ready for the bidders.

CRUISER No. 5—SAN FRANCISCO.

OFFICE OF NAVAL CONSTRUCTOR SUPERINTENDING HULLS OF VESSELS FOR U. S. NAVY, UNION IRON WORKS,
San Francisco, October 6, 1888.

SIR: I have the honor to report the condition of the work on the hull of cruiser No. 5, *San Francisco*, on the 1st instant to be as follows:

ON THE STOCKS.

The flat and vertical keels with their connecting angles from frame 21 to frame 75, completed; balance of keels 60 per cent. completed. Lower piece of stern-post, with stuffing-box, completed and in place. Thirty-four main frames below protective deck, with their respective upper pieces of reverse bar and also bracket-plates, have been raised in place. Thirteen protective deck beams are in place.

NOT ON THE STOCKS.

Four protective deck beams and forty half beams for protective deck are ready to go in place. Fifty staple angles for water-tight frames, 12 Z-bar frames below protective deck and 90 Z-bar frames above protective deck are bent to shape.

The upper piece of stern post is ready to go in place. The lower piece of stem is 98 per cent. finished. Eighteen square air-port frames are completed. Eighteen circular air-ports are 90 per cent. completed. Three 7-inch pumps and one 5-inch pump are 50 per cent. completed.

Total finished weights placed in hull, 109,723 pounds, equal 48.99 tons.

Very respectfully, your obedient servant,

F. L. FERNALD,
Naval Constructor, U. S. N., Superintending Hull.

ARMORED BATTLE-SHIP—TEXAS.

Report forwarded by the commandant navy-yard, Norfolk, Va., relating to work on the Texas.

NAVY-YARD, NORFOLK, VA., *October* 9, 1888.

SIR: Referring to the letter of the Bureau of Construction and Repair, No. 3003, dated October 1, asking, for the purpose of its annual report, what had been done towards commencing the work on the *Texas*, I have the honor to state:

When it was decided to build the *Texas* here, this navy-yard was entirely without the necessary facilities for iron-ship-building, so that the undertaking of the construction of a battle ship has required preparatory work of quite an elaborate character. During the past year the plant has been designed of such a character as to ultimately provide the yard with first-class facilities for iron-ship building, convenient and economical in arrangement. A shop has been built to include ample space for the punches, shears, planers, and other heavy machines, the beam shops, the bending slabs, and motive machinery.

Tools to the amount of $96,824 have been contracted for, of which a few have been delivered and are now being erected.

The angle-bar and plate furnaces have been completed; the slabs for the bending floors are being cast, finished, and erected, and are now two-thirds complete. A sufficient supply of hand tools peculiar to the work and which are not manufactured in trade have been made and are ready for use.

Tanks for pickling outer plating have been built, convenient cranes for handling the plates have been supplied and erected, and rapid brushing machinery made and nearly completed.

The beam-forge shed has been fitted with overhead circular cranes and hoist for handling beams at the forges, and a small furnace for heating the beam ends made.

A circular rack for storing plates, with derrick and steam hoist in the center, has been completed, except fitting the hoists.

Platform scales for weighing material have been provided and erected.

The old mold loft proving unsuitable, it was assigned to another building, a new floor made of sufficient dimensions to lay off the ship at full size, and the loft equipped with tools, battens, squares, etc.

New offices have been fitted up for the constructor's staff of draughtsmen and clerks, centrally located in the yard and convenient to the works.

The actual work of building necessarily can not be begun until the plant is ready, but such preparatory work has been done as the circumstances would admit.

The detail drawings and specifications prepared abroad have been received in piecemeal, the first lot arriving on May 7, and all have not yet been delivered. The whole have contained various inaccuracies and inconsistencies of detail which occur in complex design and which have had to be considered and reconciled.

Substantial blocking has been laid for the keel of the *Texas* on a slip directly in front of the new shop, after a careful consideration of the means of launching.

The laying off has been proceeded with in the mold loft, and the outer body is now completely faired. The large models for taking off the dimensions of the plates and the pattern for the stem and stern-post castings are being prepared.

Estimates of the amounts of steel material for the hull have been furnished, on which contracts have been made.

Very respectfully,

FRANCIS T. BOWLES,
Assistant Naval Constructor, U. S. Navy.

Chief Constructor T. D. WILSON, U. S. Navy,
Chief of Bureau of Construction and Repair,
Navy Department, Washington, D. C.

DOUBLE TURRETED MONITOR—AMPHITRITE.

OFFICE OF INSPECTOR OF HULLS, U. S. NAVY,
COLUMBIAN IRON WORKS AND DRY-DOCK COMPANY,
Baltimore, Md., October 12, 1888.

SIR: I would report that the work of putting in the drainage system (pipes, cocks, and valves) of the U. S. S. *Amphitrite*, which work, while belonging to the Bureau of Construction and Repair, but included in the contract between the Bureau of Steam Engineering and the Harlan and Hollingsworth Company, of Wilmington, Del., has been completed as far as can be before the decks are put in.

Work to be accomplished is to secure the steam-pumps, cut off the rods to bilge and manifold box-cocks, and finish the ends in deck.

As to the degree of completion of vessel the inspector is unable to state, not having the plans for completion.

The vessel as she is at present is an iron hull, with the engines completed, or nearly so. The only bulkheads in place are the athwartship bulkheads, forward and aft of the engine and boiler rooms, and the longitudinal coal-bunker bulkheads.

The bottom, as high as the armor-shelf, has been cleaned and painted with two coats of red lead and white zinc mixed.

She is now safely moored at the end of one of the piers at the company's works.

Very respectfully, your obedient servant,

W. H. VARNEY,
Naval Constructor, U. S. Navy, Inspector of Hulls.

Chief Constructor T. D. WILSON, U. S. Navy,
Chief of the Bureau of Construction and Repair,
Navy Department, Washington, D. C.

GUNBOAT NO. 2—PETREL.

OFFICE OF INSPECTOR OF HULLS, U. S. NAVY,
COLUMBIAN IRON WORKS AND DRY-DOCK COMPANY,
Baltimore, Md., October 22, 1888.

SIR: The U. S. S. *Petrel* (Gun-boat No. 2) was launched on the 13th instant, at 2 o'clock p.m., an unusually high tide greatly favoring a successful launch. The vessel was brought back to the wharf and moored with her head in a direction opposite to that of the building. A careful inspection of the inner surface of the ship's bottom failed to disclose any defective riveting. As soon as the bilge ways had been removed the draught of water was carefully measured and ascertained to be:

	Ft.	In.
Forward	4	7
Aft	7	2¼
Mean	5	10⅝

	Tons.
The displacement calculated to the launching draught is	311.60

	Tons.
Weight in vessel, hull	302.12
Machinery	9.27
	311.39
Weight in vessel not belonging to same, including workmen, staging, ladders, forges, etc	1.57
	312.97

The condition of work on the vessel at date of launching is given, in detail, in report forwarded on the 18th instant, and the "report of weights," giving in detail the weight of all material and fittings in the vessel at the time of launching, is forwarded herewith.

Very respectfully, your obedient servant,

WM. H. VARNEY,
Naval Constructor, U. S. Navy, Inspector of Hulls.

Chief Constructor T. D. WILSON, U. S. Navy,
Chief of Bureau of Construction and Repair,
Navy Department, Washington, D. C.

OFFICE OF INSPECTOR OF HULLS, U. S. NAVY,
COLUMBIAN IRON WORKS AND DRY-DOCK COMPANY,
Baltimore, Md., October 18, 1888.

SIR: In accordance with instructions contained in Bureau Circular Order No. 75, of February 14, 1888, I have to submit the following report showing the condition of work on U. S. S. *Petrel* (Gun-boat No. 2) on the 13th instant, date of launch:

	Degree of completion.
Outside plating: Fitted, riveted, and calked	Completed.
Forecastle deck: Plank laid and calked with two threads of oakum; sky-light coamings all in place	Eight-tenths.
Poop deck: Plank laid and calked with two threads of oakum; sky-light coamings all in place	Eight-tenths.
Main deck: Plank laid and partly calked; space under poop deck calked complete and payed with white lead; all coamings fitted except around coffer-dams	Seven-tenths.
Berth deck: Plank laid, except in compartment aft of bulkhead No. 91, and calked in wake of joiner-work	Seven-tenths.
Water-tight deck: All plates in place; riveting about nine-tenths completed; lower angles to girders being fitted; girders to water-tight deck angles and plates being fitted; coffer-dam plates are up and a few angles worked	Seven-tenths.
Boiler and engine hatches and coffer-dams: Plates and angles all in place and about one-third riveted; gratings to be fitted; lids to coffer-dams yet to be fitted	Six-tenths.
Stern frame	Completed.
Shaft tube: Fitted complete	Completed.
Engine foundation: Top plates fitted and all riveted	Completed.
Boiler saddles: All in place, but angles to same not yet riveted	Nine-tenths.
Rudder: Frame drilled to receive rivets of side-plates; pintles drawn in. Stock has yet to be turned off for strap	Seven-tenths.
Tiller:	
Main tiller forged, but not yet fitted	Five-tenths.
Spare tiller being machined	Seven-tenths.
Bilge keels: Completed	Completed.
Hawse-pipes: Wrought and cast iron pipes and wood-packing between same fitted complete. Wood chock around hawse-pipe fitted complete	Completed.
Pillow-block: Angles and plates fitted and riveted, complete, ready to receive bearing	Completed.
Thrust-block: Fitted and riveted, complete, ready for bearing	Completed.
Shaft-alley: Side-plates in place, and riveting nearly completed	Eight tenths.
After magazine: Bulkheads all in place and partly riveted; hatch not yet fitted	Seven-tenths.

	Degree of completion.
After shell-room: Bulkheads all in place, riveting not yet completed; hatch not yet fitted	Six-tenths.
After chain-locker: Sides and bottom plating riveted complete; top angles, grating, and cable clench yet to be fitted	Six-tenths.
Engineer's store-room aft: Side-plating completed, bottom-plating not yet riveted, water-tight door yet to be fitted	Six-tenths.
Paymaster's store-room aft: Steel work completed; hatch to same framed, lockers and shelves to be fitted	Seven-tenths.
After hold: Steel work nearly completed, battens yet to be fitted; hatch framed	Seven-tenths.
Forward magazines: Steel bulkheads nearly completed; floor plates fitted, but not yet riveted; water-tight hatch yet to be fitted	Six-tenths.
Forward shell-room: Steel bulkheads and floor nearly completed, some riveting yet to be done; water-tight hatch yet to be fitted	Six-tenths.
Fresh-water tanks: Main tank nearly completed but manhole-plate is yet to be fitted; side tanks partly fitted, but not riveted	Four-tenths.
Forward fixed-ammunition room: Steel bulkheads and floor fitted, riveting not all completed; hatch yet to be fitted	Six-tenths.
Forward chain lockers: Steel work all completed; cable clench yet to be fitted; hatch cover yet to be made	Eight-tenths.
Forward store-room: Platform angles fitted and margin plank laid	Two-tenths.
Joiner work:	
Skylights for poop deck in course of construction	One-tenth.
Beam and door casings under poop deck being fitted; firring for overhead paneling completed and grub cleats for state-rooms, etc., fitted	Two-tenths.
Grub cleats fitted forward for seamen's and officers' closets on main deck and for dispensary on berth deck	One-tenth.
Hard wood ladders all cut out	Six-tenths.
Cement: The ship has been cemented throughout up to turn of bilge with a composition of Roman cement and asphaltum	Eight-tenths.
Air-ports: All round air-ports fitted in place, but drips have yet to be fitted to same; square air-ports forward and aft yet to be made and fitted	Seven-tenths.
Mooring bitts: All secured in place	Completed.
Warping pipe, : In place; lanyards, bucklers, etc., yet to be fitted	Seven-tenths.
Rudder-carrier and stuffing-box: Fitted in ship	Completed.
Gun sponsons and supports: Sponsons fitted complete except shutters; cylindrical supports fitted complete, but not all riveted; shelving, doors etc., yet to be fitted to same	Six-tenths.
Sluice-valves: All fitted in vessel, but rods, indicators, and other fittings not yet in place	Seven-tenths.
Coaling scuttles: All made, but have yet to be galvanized and fitted in ship	Seven-tenths.
Freeing ports: Shutters fitted to ship, but hinges not yet riveted; fastenings and other fittings yet to finish	Six-tenths.
Pumping and drainage arrangements: Some fittings already made and fitted, such as valves, stainer-boxes, manifolds, etc.; no pipes run	Two-tenths.
Chain nippers: Completed and ready to be secured in place	Eight-tenths.
Deck stanchions: Nearly all in place	Nine-tenths.
Hatch canopies: Not yet made; castings for same riveted in hatches	One-twentieth
Rail stanchions: Stanchions all made and ready to be fitted in vessel	Five-tenths.
Cot and hammock hooks: Made and ready to be fitted in place	Eight-tenths.
Bulkheads: All bulkheads except No. 67 are now fitted in place and nearly all riveted and calked. All water-tight doors have yet to be fitted	Eight-tenths.
Painting: The whole of the steel work in the hull has been painted and the bottom, outside, has been treated to two coats of two-thirds red lead and one-third white zinc, mixed; the outside above the water-line has been coated with Hertzog's composition cement	Three-tenths.
Patterns: The following patterns are being made: Manhole-plates for water-tanks, square air-ports, scupper pipes, hatch frames for forward magazines, etc., passing scuttles, light-box scuttles, etc.	
Hammock berthing: Plates and angles in place and riveted; wood-rail fitted; bottom boards yet to be fitted; eye-bolts for hammock-cloths yet to be fitted	Seven-tenths.
Light-boxes to magazines, etc.: openings cut in decks and bulkheads for same but boxes not yet fitted	One-tenth.

Degree of completion.

Distilling from side bulkheads completed, but door not yet fitted ....Six-tenths.
Coaling trunks, etc.: openings cut for same in bulkheads but trunks not yet framed ....One-twentieth.
Awning stanchions: Stanchions not yet made; braces riveted in place. One-twentieth.
Total weight of all material placed in hull, 697,513 pounds, equal to 311.39 tons.

Very respectfully, your obedient servant,

WM. H. VARNEY,
Naval Constructor, U. S. N.,
Inspector of Hull.

Chief Constructor T. D. WILSON, U. S. N.,
Chief of Bureau of Construction and Repair,
Navy Department, Washington, D. C.

CRUISER No. 3—BALTIMORE.

OFFICE OF INSPECTOR OF HULLS FOR U. S. NAVY,
WM. CRAMP & SONS, SHIP AND ENGINE BUILDING COMPANY,
Philadelphia, Pa., October 9, 1888.

SIR: Herewith is submitted report of progress of work upon the hull of the United States cruiser *Baltimore* at these works during the months of August and September, ultimo:

Item.	Condition.	Required to complete.
Rudder	Completed	
Shaft tubes and struts	......do	
Beams, skid for boats	Material on hand	
Outside plating	Completed	
Inner bottom	......do	
Bulkheads below main deck	Completed, except doors which are being fitted.	One-tenth
Bulkheads below protective deck.	......do	Do.
Bulkheads, coal bunkers, below protective deck.	......do	Do.
Boiler bearers, etc	Completed, except riveting	Two-tenths.
Holes in bulkheads for engineer's pipes.	Completed, for other pipes being cut as required.	Five-tenths.
Stanchions in hold and between decks.	All in place except after platform	One-tenth.
Water-tight doors, sluice valves, etc.	Material on hand for the doors. For the screens to be fitted around, the material is not on hand. Manholes in inner bottom are cut and rings and covers fitted, where practicable.	Three-tenths.
Sounding tubes	Cast-iron flanges and tees securely bolted on frames No. 6 and 88. Materials to complete on hand, except brass deck-sockets, not yet cast.	Nine-tenths.
Coal shutes and scuttles to coal bunkers.	Completed in bunkers, except door fastenings	Four-tenths.
Passing scuttles	Material on hand, not commenced	
Shell rooms	Completed, ready for painting	Two-tenths.
Torpedo magazines	......do	Do.
Fixed ammunition rooms	......do	Do.
Torpedo outfit and store room	......do	Do.
Plank sheers or waterways	In place on main deck, except under and on forecastle and poop decks.	Three-tenths.
Deck plank	Completed on gun deck, except forward of galley. On hand to complete all decks.	Seven-tenths.
Supports under 8-inch gun	Completed, except door fastenings	One-tenth.
Supports under 6-inch gun	......do	Do.
Platforms etc., for guns	Material on hand not commenced	
Port framings and shutters	For coal ports all in place, fastenings incomplete.	Four-tenths.
Freeing ports	Holes cut, material on hand	Eight-tenths.
Casing to engine and boiler hatches.	Engine hatches, forward and after. All angles and plates in place and riveted. Boiler hatches forward and after. Plates all in place above main and on protective deck, angles are in place and riveted. Angles for and about one-half the glacis plates, are in place. Material on hand to complete.	Five-tenths.
Coffer-dam casings between engine hatch.	Completed	

Item.	Condition.	Required to complete.
Berth and protective decks	Boiler hatch. angles and plates on hand, not laid off.	Seven-tenths.
Mast steps	Material not on hand	
Ash chutes	Plating in hammock berthing nearly all fitted and ready for riveting. Outside plates templated off. Chutes not secured.	Nine-tenths.
Scuppers	About eighteen sections in place, not yet secured, remainder ready for fitting in ship. A few openings cut in outside plating.	Eight-tenths.
Air ports	All finished in shop. Brass castings in place on main deck ready for lenses. In cabin, all holes cut for square ports, and castings in place ready for lenses. Forward of cabin, all holes are cut and frames in place except one. Under forecastle, all holes are cut, frames not in place.	Two-tenths.
Hammock berthings and bulwarks.	All framing and bracket plates in place. Inner plating being templated off.	Six-tenths.
Covers to openings on protective deck.	Material on hand	
Gratings and hatch covers	Not commenced	
Coamings and head ledges	Completed except mahogany work on poop-deck.	One-tenth.
Sky-lights and deck-lights	Sky-lights finished in shop, ready to place on board. Deck-lights not received.	Six-tenths.
Canopies	Material in shop	
Ceilings in hold and store-rooms	Completed	
Chain lockers	All angles and plates in place and riveted	One-tenth.
Iron rounds or ladders	Completed	
Engineer's workshop or store-room.	Angles and plates in place and riveted	Four-tenths.
Ordnance workshop	do	Four-tenths.
Awning or sail room	Completed except rollers and painting, having been given one coat.	One-tenth.
Ventilation to engine and boiler rooms.	Completed between protevtive and upper decks.	Four-tenths.
Ventilation	Material on hand, not commenced	
Ventilation of coal bunkers	do	
Fresh-air supply to bunkers	do	
Forced draught in fire-rooms	do	
Pumps	Two "Calkins'" 5½ inch, received. Holes cut in shell and steel rings being fitted.	One-tenth.
Casings for pipes, etc	Material on hand not commenced	
Bridge	do	
Manger	Partially completed	One-tenth.
Ring-bolts in deck	Material on hand, not commenced	
Anchor davits	Being finished in shop	Seven-tenths.
Bill-boards	Material on hand, not commenced	
Boat davits and cradles	do	
Warping pipes	do	
Awning stanchions	do	
Securing-bolts	do	
Attachments for rigging	do	
Chain-plates, bolts, etc	do	
Guard rails and stanchions	do	
Life-buoy guards	do	
Jacob's ladders)	do	
Chocks for fairleaders	Not received	
Ensign staff (fittings for)	Material on hand, not commenced	
Eye-bolts in beams	do	
Hawse pipes	Tubes riveted in place, ready for yellow pine chocks, and castings, two of which are on hand.	Eight-tenths.
Stern pipes	Patterns not made	
Bow stoppers	do	
Deck pipes	do	
Windlass and capstan	Received	
Warping or towing bitts	Completed and secured in place	
Wire cable nippers	Received	
Ladders to hatchways, etc	Material on hand, not commenced	
Ladder (side) sea steps, etc	do	
Wardroom and cabins on berth deck.	All paneled doors, drawers, berth fronts, and divisional bulk-heads completed, except brass wire panels, which have not been received, and ready to place on board. Beams cased. Furring in place on frames. Sheathing and overhead paneling partly finished. Material on hand for shelving, etc.	Fourth-tenths.
Cabins under poop deck	Sections, divisional bulk-heads, etc., ready to place in ship. Other fittings not received.	Four-tenths.
Steerages	Same degree of progress as cabins under poop deck.	Four-tenths
Hammock hooks	Not received	

Item.	Condition.	Required to complete.
Shot racks and musket racks	Not commenced	
Hatch covers	Materials on hand, not commenced	
Lumber irons	do	
Brass label plates	Not received	
Reels	do	
Prisons	Material on hand, not commenced	
Oil tank	do	
Lamp-room	do	
Fresh-water tanks	Completed, ready for covers, pipes, etc	Three-tenths.
General and other store-rooms	All completed, except gratings and painting, having received but one coat.	Two-tenths.
Chronometer and compass lockers.	Material on hand, not commenced	
Signal lockers	do	
Mess and clothes lockers for crew.	Not received	
Swinging tables and benches for crew.	Received	
Paymaster's office	Material on hand, not commenced	
Armory	do	
Pantries	do	
Galley-house	Angles in place and riveted. All plates in place except on one side to admit stove.	Seven-tenths.
Master-at-arms' locker	Material not on hand	
Water-closets	Fixtures not received	
Lavatories for officers	Material not on hand	
Firemens' washroom	Ready for fittings	
Surgeon's examining room	Materials on hand, not commenced	
Dispensary	do	
Speaking tubes and telegraphs	Fixtures not on hand	
Wooden pilot-house	Framing completed ready to place in position. Material for joiner's work, inside rails, etc., on hand. Speaking tube, rudder tell-tale, steam stearing wheel, engine-room telegraphs and indicator, not received. Water-tight hinged covers not commenced.	Five-tenths.
Conning tower, shield, etc	Material not received	
Steering apparatus	Connecting links and two small stands finished. Two large stands, two small screws and guide rods partly completed.	Eight-tenths
Watch bell	Received	
Running lights	Not received	
Head and stern ornaments	do	
Electric lighting apparatus	Fixtures not received	
Electric call-bells	do	
Painting and otherwise coating steel, iron, and wood work.	Outside, cementing and bottom completed. Inside, forward magazine, store-rooms, sail room, and under side of upper deck have received the necessary coats of red lead and cork paint; the remainder has been given one coat of red lead.	Six-tenths.
Cement	In bottom, finished under after magazine, and as far aft as the stern post, and now being placed under engine room.	Six-tenths.

Total finished weights placed in hull, $1,919\frac{16}{2240}$.

Very respectfully, your obedient servant,

J. F. HANSCOM,
Assistant Naval Constructor, U. S. N., Superintending Constructor.

Chief Constructor THEO. D. WILSON, U. S. N.,
Chief of Bureau of Construction and Repair, Navy Department, Washington, D. C.

CRUISER No. 3—BALTIMORE.

OFFICE OF SUPERINTENDING CONSTRUCTOR FOR U. S. NAVY,
WM. CRAMP & SONS, SHIP AND ENGINE BUILDING WORKS,
Philadelphia, Pa., October 23, 1888.

SIR: I have to report the successful launching of the U. S. S. *Baltimore* (Cruiser No. 3) on Saturday, the 6th instant, at 2.25 p. m.

Following is a statement of weights in hull and on board, together with corresponding draught per scale of displacement, and the actual draught and trim of vessel:

	Tons.
Weight in hull, as per account	1,861 $\frac{701}{2240}$
Weight of machinery on board	64 $\frac{1387}{2240}$
Total weight belonging to vessel	1,925 $\frac{2088}{2240}$
Weight of anchors, chains, ropes, etc	56 $\frac{1070}{2240}$
Weight of men on board (estimated)	6
Total weight on board	1,988 $\frac{918}{2240}$

Actual draught and trim:

	Ft.	In.
Forward	7	7½
Aft	14	11¼
Mean	11	3$\frac{3}{8}$

Displacement per scale at actual (mean) draught ....tons..	1,995
Excess of actual displacement over weight as per account (2,011.29—1,988.41) ....tons..	22.88
Displacement as calculated ....do..	2,011.29
Tons per inch of immersion at launching plane ....do..	21.32
Longitudinal metacenter above center of buoyancy ....feet..	561.88
Transverse metacenter above center of buoyancy (from scale) ....do..	15.72
Center of gravity of launching water plane abaft dead flat ....do..	7.04

Very respectfully, your obedient servant,

JOHN F. HANSCOM,
Assistant Naval Constructor, U. S. N., Superintending Constructor.

Chief Constructor T. D. WILSON, U. S. N.,
Chief of Bureau of Construction and Repair,
Navy Department, Washington, D. C.

CRUISER No. 1—NEWARK.

OFFICE OF INSPECTOR OF HULLS FOR U. S. NAVY,
WM. CRAMP & SONS' SHIP AND ENGINE BUILDING COMPANY,
Philadelphia, Pa., October 9, 1888.

SIR: Herewith is submitted report of progress of work upon the hull of the U. S. cruiser *Newark* (Cruiser No. 1) at these works, during the months of August and September, 1888:

Items.	Condition.	Required to complete.
Vertical keel	All plates and upper and lower bars in place and riveted, except six plates and angle-bars.	Four-tenths.
Flat keel	One outer and two inner plates forward required to complete. All others riveted in place.	Two-tenths.
Transverse frames	From No. 30 to No. 75, inclusive riveted in place.	Six-tenths.
Beams, protective deck	......do	Six-tenths.

Total finished weights placed in hull, 64 $\frac{1858}{2240}$.

Very respectfully, your obedient servant,

J. F. HANSCOM,
Assistant Naval Constructor, U. S. N., Superintending Constructor.

Chie Constructor T. D. WILSON, U. S. N.,
Chief of Bureau of Construction and Repair,
Navy Department, Washington, D. C.

CRUISER No. 4—PHILADELPHIA.

OFFICE OF INSPECTOR OF HULLS FOR U. S. NAVY,
WM. CRAMP & SONS' SHIP AND ENGINE BUILDING COMPANY,
Philadelphia, Pa., October 11, 1888.

SIR: Herewith is submitted report of the progress of work upon the hull of the **U. S. Cruiser No. 4,** *Philadelphia*, at these works, during the months of August and **September,** 1888:

Items.	Condition.	Required to complete.
Flat keel	Completed	Five-tenths.
Vertical keel	do	
Stem piece	Lower portion in place; upper received, not yet fitted.	
Stern-post	Fitted in place	Four-tenths.
Framing in wake of double bottom and below protective deck.	Completed	
Transverse framing before and abaft double bottom and below protective deck.	do	
Transverse framing above protective deck.	About one-third the top frames are in place. Others ready to place in position.	Seven-tenths.
Beams, upper deck	About one-third placed in position; others being prepared for raising.	Seven-tenths.
Beams, main deck	Same degree of progress as on upper deck	Seven-tenths.
Beams, protective deck	Completed	
Beams, platform	do	
Beams, magazine crown	do	
Outside plating	A, B, C, and D strakes are completed, except one plate left off of B strake, to facilitate work. On E strake two plates are yet required; on F, one; G, eleven; H, nineteen. None have yet been placed on the remaining strakes, except one on K.	Six-tenths.
Gutter or flat keelson plates	Completed	
Inner bottom	Plates are all in place and riveted, except one directly over B strake, outside (to facilitate work); water-tight angles on top being fitted in place.	Three tenths.
Breast-hook, for support of stern	Completed	
Protective deck-plating	On A strake three plates are yet required. On B, four; C, six; D, nine; E, twenty; I, eighteen; all are yet required on K and P strakes. On M, twenty-three; N, eighteen, and O, twelve; F, G, and H strakes are completed. The angles to connect with skin plating are about one-half finished.	Seven-tenths.
Bulkheads above protective deck.	Several plates ready to place in position, others being templated off. Material on hand to complete.	Nine-tenths.

Total finished weights placed in hull, $637\frac{1}{2}\frac{33}{40}$ tons.
Very respectfully, your obedient servant,

J. F. HANSCOM,
Assistant Naval Constructor, U. S. N., Superintending Constructor.

Chief Constructor T. D. WILSON, U. S. N.,
Chief of Bureau of Construction and Repair,
Navy Department, Washington, D. C.

DOUBLE TURRETED MONITOR—MONADNOCK.

***Report** forwarded by commandant navy-yard, Mare Island, California, showing condition of work on the hull of the U. S. monitor Monadnock during the month of September,* 1888.

NAVAL CONSTRUCTOR'S OFFICE,
U. S. Navy-Yard, Mare Island, California, October 17, 1888.

In reply to Bureau's letter, No. 3217, desiring information as to the progress of work **on the hull** of the *Monadnock* during the month of September, etc., I have to state as **follows:** No new work has been added to the hull; the fore and aft bulkheads under

the turrets have been partly removed to conform to the new internal arrangement; all pockets in the ship where water might find lodgment have been cleaned and painted; the truss-work put up to insure the ship from straining while being launched has been removed; all temporary hatch coverings have been repaired and the vessel put in a proper condition to suffer no damage from the rains of the approaching winter. As to the degree of completion of the *Monadnock* I would say that it is practically the same as up to the end of August last, and in substance as given in my letter to the Bureau of September 4, 1886, a copy of which is herewith inclosed.

Very respectfully, your obedient servant,

J. FEASTER,
Assistant Naval Constructor, U. S. Navy.

U. S. NAVY-YARD, MARE ISLAND, CAL., *September* 4, 1886.

SIR: In compliance with the Bureau's order of August 17, 1886, requiring a report to be made showing the exact condition of work on the double-turreted monitor *Monadnock* as she now is, and stating what materials, if any, are on hand belonging to her and intended to be used in her completion, I have the honor to state that I have carefully examined the vessel and would respectfully report as follows:

Hull.—The outside of the hull appears to be completed and shelf ready to receive the wooden backing and armor plates.

Upper deck.—The plates on the upper deck are laid, secured, and calked ready for the wooden deck, with the exception of the space over the boilers and the sides where the armor is to be placed. All the hatches and other openings through the deck plating are cut and the battle plates fitted to the former. The deck lights are in and fitted with iron gratings on top. The coal scuttles are cut and fitted with their battle plates.

Bitts.—The cable and mooring bitts, also the chocks, are fitted and secured.

Hold.—The inner skin or plating is in place, secured and calked. Manholes are cut and fitted with covers athwartships and fore and aft. The bulkheads are up, secured, and calked. The shaft alleys are built and the after pieces of shaft are in place with the propellers shipped and secured. The rudder is shipped and fitted with temporary tiller. The coal-bunkers and the turret bulkheads are up, secured, and calked. The berth-deck beams are in, fore and aft, and secured with stringers on the the sides, also secured and ready to receive the wooden decking. The stanchions are up and secured. The hooks for strengthening the ram and the capstan bed are in place and secured. The flood-cocks for magazines and other purposes are in place and secured ready for making the connections. The wing-passage bulkheads between decks are in place and secured.

Material for completion.—The following material belonging to the vessel and intended to be used in her completion is on hand at this navy-yard, viz: 14 plates ⅝-inch iron for boiler-beds, weighing 15,120 pounds; 60 plates ⅞-inch iron for deck purposes, weighing 126,000 pounds, which will probably be sufficient to complete the iron deck; 1 lot ⅞-inch iron rivets, weighing 53,000 pounds. Total weight of material on hand, 194,120 pounds.

Very respectfully, your obedient servant,

J. FEASTER,
Assistant Naval Constructor, U. S. Navy.

DOUBLE TURRETED MONITOR—PURITAN.

Report forwarded by commandant navy-yard, League Island, Pa., showing the progress of work on the Puritan up to and including September, 1888.

NAVAL CONSTRUCTOR'S OFFICE,
U. S. Navy-Yard, League Island, Pa., October 17, 1888.

SIR: In obedience to the Bureau's order of the 9th instant, No. 3219, to forward, without delay, the report of the progress of the work on the hull of the *Puritan*, together with the report of the degree of completion up to and including the month of September, 1888, I have the honor to report that the *Puritan* arrived at the League Island navy-yard, on April 21, 1886, from the Delaware River Iron Works, Chester, Pa.

The structural part of the hull is completed, such as the frames, keelsons, longitudinals, stem and stern posts, inner and outer bottoms, armor shelves and frames, collision, after, and other transverse bulkheads, fore and aft bulkheads forming passages, coal bunkers and turret chambers, upper-deck beams and armor plating, lower-

deck beams, stringers, and ties with stanchions in the hold and between decks; the rudder is hung and fitted with journals, stuffing-box and temporary tiller, shaft struts, with all attachments for supporting the shaft and propeller.

Openings have been cut in the armor plating for the hatches, smoke-stack, ventilators, and deck lights; the stack and ventilators are fitted, and in many cases the deck lights; no wood decks have been laid nor any wood-work necessary to completion done. Sluice valves have been fitted for draining within the double bottom.

Soon after arriving at League Island all the iron-work of the hull was thoroughly scraped and painted, including the keelsons, longitudinals, and frames between the inner and outer hulls, and the outside of the vessel above the water-line.

For the purpose of towing the vessel to Norfolk navy-yard, it has recently been fitted with a temporary bridge and house of wood, secured to the armor deck, containing two boats, stoves, and accommodations for four officers and twenty men; on the bridge side lights and mast for signaling were fitted, and steering wheel with ropes rove in fairleaders on the armor deck, leading to the temporary tiller below; the stem from the shelf to the armor deck was strengthened with timber extending to the outer edge of the shelf and temporary hawse chocks were fitted thereon.

There were also fitted on the armor deck forward bridle-chocks and iron bitts for towing or riding at anchor; two anchors with davits trips and about 200 fathoms of chain cable, a crab or windlass, and ring stoppers for securing the chain; a ship's bell and water-tank were fitted under the bridge, and binnacle-boxes and closets for officers and men near by; whale-boat and second cutter with davits to hoist and lower the boats, life-buoy, flag-staff, and bilge-pumps.

All the deck openings and hatches were closed up, except a companion hatch to engine-room, which gave access throughout the vessel below.

The windlass and steam steering.gear belonging to this vessel that has been stored at this yard were shipped—the heavy portions secured to the deck armor, the smaller portions boxed and placed below.

Very respectfully, your obedient servant,

R. W. STEELE,
Naval Constructor, U. S. Navy.

No. 9.—BUREAU OF STEAM ENGINEERING.

NAVY DEPARTMENT,
BUREAU OF STEAM ENGINEERING,
Washington, November 1, 1888.

SIR: I have the honor to submit to the Department the annual report of this Bureau, together with the estimates for the fiscal year ending June 30, 1889:

APPROPRIATION, STEAM MACHINERY, 1888.

Amount appropriated for the fiscal year ending June 30, 1888, Act approved March 3, 1887		$675,000.00

EXPENDED TO NOVEMBER 1, 1888.

For labor in the navy-yards and stations, in repair of steam machinery, boilers, etc., of naval vessels fitting for sea-service; and preservation of tools, handling and preservation of materials, stores, etc	$403,193.42	
For purchase of materials, stores, machine-tools, freights, and incidental expenses	194,234.95	
For payments on foreign stations, for repairs, materials, freights, and incidental expenses	57,232.82	
Total	654,661.19	
Less repayments by transfers in the adjustment of appropriations	21,722.77	
Total expenditure		632,938.42
Balance on hand		42,061.58

OBLIGATIONS OF THE BUREAU TO BE PAID FROM THIS BALANCE.

For approved requisitions unfilled (estimated)	3,564.24
Balance remaining to the credit of this appropriation	38,497.34

APPROPRIATION, MACHINERY, DOUBLE-TURRETED MONITORS, ACT APPROVED MARCH 3, 1883.

Balance on hand, November 2, 1887, as per last annual report		$115,452.32
Expended in settlement of contract for machinery of *Terror*	$56,695.63	
Balance yet due on contract for machinery of *Amphitrite*	52,178.11	
		108,873.74
Balance to the credit of this appropriation		6,578.58

This balance of $6,578.58 will be required to pay for cost of steam trials of the vessels and extras to contract when completed.

GENERAL OPERATIONS OF THE BUREAU.

The Bureau has prepared during the past year plans and specifications for machinery for the *Maine* and *Monadnock*, and has prepared specifications for the machinery for the *Texas* as far as the plans, made by the Naval Construction and Armaments Company of Barrow-in-Furness, England, have been received. Preliminary plans have also been made for the machinery of one of the coast-defense vessels about to be built, and for some of the vessels authorized by the act of September 7, 1888. Considerable work has also been done in the way of preparing designs for increasing the efficiency of the machinery of the old vessels, by adopting late improvements in such parts as have to be renewed when repairs are made. Plans have been prepared for new compound condensing machinery for steam cutters and launches. The machinery for the *Yorktown's* launch is now being built; also machinery for a large launch for the Training Station and one for the Pensacola navy-yard. Machinery has been procured by purchase for the commandant's barge at the New York navy-yard and fitted in place.

Preliminary steps have been taken to have the machinery for the *Baltimore's* cutter built by contract by the Hohenstein Manufacturing Company, of Newark, N. J., with a view to testing their boiler system. On account of the reputed success of various forms of coil and sectional boilers in yachts and torpedo-boats, and in view of the necessity of greater power in war-ships without increase of weight, it has been thought advisable to make practical tests of such of these boilers as appear to possess merit. To this end, boiler-makers have been invited to enter into a competition to furnish coil-boilers for one of the new vessels. In answer to the Department's advertisement, plans have been received, as elsewhere noted in detail, and are now being considered.

Plans have been prepared for machinery for the *Monadnock*, material has been advertised for, and the work of construction has begun at the navy-yard, Mare Island, Cal. A description of the machinery will be found elsewhere.

The overhauling of the *Swatara's* machinery, with the putting in of new boilers and forced draft appliances, has been completed, and the vessel is now on a foreign station. An attempt was made to try the machinery at full speed power in Hampton Roads; but the trial was frustrated and the boilers injured by muddy water being let into the boilers while the vessel was in dock. When an attempt was made to speed the engines the boilers primed so badly as to start extensive leaks in the tubes. Upon leaving New York the boilers were tried with clean water, when for a short time the engines developed a greater power than they had ever previously done, but the unskilled fire-room force was unequal to the task of keeping up the fires.

The work on the *Kearsarge* has nearly been completed, and the machinery given a very satisfactory preliminary dock-trial. The engines which have been put into this vessel to replace those worn out are some which were taken out of the *Nantasket*. The boilers were built for the *Swatara* and *Alliance*, but not used in those vessels on account of the adoption of forced draft and a consequent diminution of the number of boilers.

The old boilers have been taken out of the *Pensacola* and preparations made to put in new ones which were on hand.

The machinery of the *Iroquois* is undergoing extensive repairs. Repairs of varying extent have been made on a number of other vessels as elsewhere noted.

The floating derrick at the New York navy-yard has been completed, and is in successful use.

The construction of the new cruisers and gun-boats has entailed a large amount of work in the way of inspection, records, drafting, correspondence, etc. The state of the work on the machinery of the various new vessels will be found noted under a separate head.

WORK DONE ON THE MACHINERY OF NAVAL VESSELS.

The following shows, briefly, the character and amount of work done on the machinery of all vessels, whether in commission, laid up for repairs, or in ordinary, during the fiscal year ending June 30, 1888. The cost of the work, together with that of stores and outfits, will be found in the succeeding tabular statement.

Adams.—New distiller pump, new packing for cylinder-relief valves, new spindles for reversing cylinder, sections of blow and drain pipes, and new pass-over valve—all fitted in place by the engineer's force on board. Material supplied by Honolulu Iron Works. Repairs to engines and steam-launch machinery incident to continuous service. Ship in continuous commission.

Ajax.—Preservation of machinery.

Alarm.—Preservation of machinery.

Alert.—Standard of reversing engine repaired and small castings for steam launch made and fitted on shore at Callao. Repairs incident to continuous service made by the engineer's force on board. The principal part of repairs made to steam-launch machinery. Ship in continuous commission.

Alliance.—New man-hole plate for inboard end of low-pressure cylinder, several pipes and small valves and fittings made and repaired on shore. Repairs incident to continuous service made by engineer's force on board. Ship in continuous commission.

Atlanta.—Separator fitted to dynamo engine; steam pipe for search-light engine; grate bars; discharge pipes from hot-wells replaced by oval castings; additional heaters fitted on gun-deck; outboard valves examined and repaired where necessary; new coil boiler, separator, injector, pump and smoke pipe put into steam launch; minor repairs. The work was done at the New York navy-yard, assisted by engineer's force on board. New rock shaft for compressing-pump of ice machine forged on shore, finished and fitted by force on board. Repairs incident to continuous service. Ship in continuous service.

Boston.—New brasses fitted to one main journal; new joints in main steam-pipe; boilers tested; reversing engine and low-pressure cylinder relief valves overhauled; furnaces fitted with cast-iron plates; bottoms of boilers cemented; new ash-hoisting engine placed in position; crank brasses re-Babitted; telescopic oiling arrangements fitted; furnace-doors altered; extra boiler man-hole plates and braces made; main cut-off valve stems repaired; repairs to piping; minor repairs. The work was done at the New York navy-yard, assisted by engineer's force on board. Changes in ash-hoisting engines, ash-chutes, and in ventilating-blowers, and minor repairs and alterations made by engineer's force on board. Ship in commission at New York navy-yard.

Brooklyn.—Boilers repaired and covered with felt; boiler-tubes and steam launch engine repaired by shore parties. Outboard valves and shaft examined and repaired where necessary; boilers scaled twice; boilers partly retubed on account of scaling; minor repairs to engines, boilers, feed-water heater, and steam-launch machinery by engineer's force on board. Ship in continuous commission.

Camanche.—Preservation of machinery.

Canonicus.—Preservation of machinery.

Catalpa.—Minor repairs incident to service as yard tug at New York navy-yard.

Chicago.—Brasses of main engines overhauled; low-pressure main valves removed, altered, and replaced; small repairs to boiler seams, and to main steam and exhaust pipes, by contractors' force, assisted by force on board. Small engineer's force on board engaged in preservation of machinery. Making pipes for dynamo engine; alterations to check and blow valves; minor work at New York navy-yard.

Cohasset—Piston and follower faced, and new bull ring made; new crank-pin and brasses; altering steam-pipe; general repairs to engine and boilers. The work was done at the New York navy-yard.

Despatch.—Boiler tubes ferruled in part; outboard valves overhauled; new division plates fitted in back connections of boilers; new dry-pipe for after boiler cast; and minor repairs to engines. The work was done at the New York navy-yard with

the assistance, whenever practicable, of the force on board. New steel crank-pin for launch engine fitted; cracked crank repaired; boiler coil repaired; and machinery of steam-launch generally overhauled; condenser cleaned and tubes partly renewed; new dry-pipe fitted in after boiler; minor repairs to engines and boilers incident to continuous service by engineer's force on board. Ship in continuous commission.

Dolphin.—Cemented bottoms of boilers; reversing-engine rock-shaft raised and adjusted; new check valves made and fitted to boilers; new brasses for ash-hoisting engine; repairs to piping; repairs to machinery of both steam launches; one new tank and one new boiler fitted. The work was done at the New York navy-yard. Calking seams of shells and furnaces; new bridge walls built; air pump valves renewed; main engine cross-heads and gibs relined and adjusted; and minor repairs by force on board. Ship in continuous commission.

Emerald.—Made new stern bearing, keel condenser, and propeller. Minor repairs to machinery. This was done at the Portsmouth navy-yard.

Enterprise.—New brasses fitted to low-pressure crank-pin; tubes expanded in steam-launch boiler; boilers scaled; exhaust pipes of auxiliary machinery led into condenser; and minor repairs by engineer's force on board. Ship in continuous commission since October 4, 1887.

Essex.—Boilers extensively repaired; main valve and reversing gears thoroughly repaired and adjusted; and repairs to steam-launch machinery, by shore parties. Repairs to main and steam-launch machinery incident to service by engineer's force on board. Ship in continuous commission.

Fortune.—New air, circulating and feed pumps, and a new condenser have been put in, the old condensing apparatus having been completely wrecked; minor repairs to engines and boilers. The work was done at the New York and Norfolk navy-yards.

Franklin.—Put in and connected one additional cylindrical boiler for auxiliary purposes, two furnaces of one main boiler having been cut out to make room for this boiler; forward smoke-pipe and fittings of both forward main boilers removed to store; fresh-water tanks fitted on top of boilers; and repairs to steam-launch machinery and auxiliary boiler. The work was done at the Norfolk navy-yard, assisted by the small engineer's force on board.

Galena.—Repairs to engines; eight boilers repaired, seven of them retubed; boiler uptakes extensively repaired; new engine and boiler put in steam-launch; minor repairs. This work was done at the Norfolk navy-yard, with the assistance of the force on board, whenever practicable. Boilers scaled; one boiler repaired for auxiliary purposes; and minor repairs by engineer's force on board. Ship in continuous commission.

Hartford.—Work on repairs suspended.

Intrepid.—Preservation of machinery.

Iroquois.—The cracked forward piston-rod, broken air and feed pump rods repaired, and after piston-rod straightened by shore parties. Circulating plates put in boilers; boilers and steam-drums scaled; sea-valves ground in; ferrules put in tubes of four boilers; and minor repairs by engineer's force on board. Ship in commission until March 6, 1888. Engines are now being thoroughly overhauled and boilers repaired at the Mare Island navy-yard.

Jamestown.—Fitted heater-pipes and made connection to distilling-boiler at the Norfolk navy-yard.

Jason.—Preservation of machinery.

Juniata.—New pins and brasses for ice-machine, and repairs to auxiliary pumps made by shore parties. Repairs to engines and boilers by engineer's force on board. Ship in continuous commission.

Kearsarge.—New boilers have been put in; and *Nantasket's* engines overhauled and placed in this ship; made new steam-pipes and heaters; general refitting. The work was done at the Portsmouth navy-yard.

Lancaster.—New propeller and shaft for steam-launch made at Norfolk navy-yard. New suction pipes to forward auxiliary pumps made; extensive patching and repairing of boilers; cracked condenser channel-plate, partition, and foot-valve seat repaired by shore parties, with assistance of force on board. Continuous repairs to boilers, repairs to pipes and blow-valves; new boiler and propeller-shaft fitted in steam-launch; outboard valves examined; new sight-feed lubricators fitted to main valve-chests; repairs to steam-launch machinery, and minor repairs incident to long-continuous service by engineer's force on board. Ship in continuous commission.

Lehigh.—Preservation of machinery.

Leyden.—Overhauled machinery and retubed boiler. The work was done at the Portsmouth navy-yard.

Mahopac.—Preservation of machinery.

Manhattan.—Preservation of machinery.

Marion.—New balancing arrangement for high-pressure valve; high-pressure engine aligned, valve-faces planed and scraped, and new valve-stem fitted; low-pressure piston-rods repaired; new core-plugs secured in low-pressure piston; both clutch-

couplings repaired, and shaft aligned as well as possible; both cross-tails repaired and aligned; new packing rings for cylinder relief valves; auxiliary pumps thoroughly repaired; bottom blow sea-valves repaired; new piping where required; new lignum-vitæ packing for feed and bilge pumps. The work was done at the Honolulu Iron Works, and at the Government dock-yard, Yokosŭka, Japan. Boiler and pipe-covering renewed where necessary; boilers scaled; leaks in bottoms of boilers cemented and leaky tubes expanded; distiller repaired, and minor repairs incident to long-continued service, by engineer's force on board. Ship in continuous commission.

Mayflower.—Engines and boilers overhauled and piping repaired. The work was done at the Norfolk navy-yard.

Miantonomoh.—Made templates for turret, and fitting turret-turning engines; preservation of machinery and minor repairs. The work was done at the New York navy-yard.

Michigan.—Shoulders in cylinders removed and counterbore extended; repairs to one paddle-wheel and main feed-pump plunger, and minor repairs incident to service to main and steam-launch machinery, by the engineer's force on board. Ship in continuous commission.

Minnesota.—New propeller and section of shaft for steam-launch and repairs to latter at New York navy-yard. Numerous repairs to main boilers, and machinery of steam-launch extensively repaired by engineer's force on board.

Mohican.—New springs fitted to both pistons; cylinder relief-valve gear repaired; part of boilers scaled; tubes of steam-launch boiler partially renewed, and minor repairs by engineer's force on board. A new safety-valve stem and cap-nut for launch propeller were made on shore. Engines and boilers are now being thoroughly overhauled at the Mare Island navy-yard. Ship in continuous commission.

Monocacy.—Scaled boilers; minor repairs to main and launch machinery by force on board. Ship in continuous commission, but at anchor in Yokohama during the year, except when out for target practice.

Montauk.—Preservation of machinery.

Monterey.—Minor repairs incident to continuous service were made at the Mare Island navy-yard.

Nahant.—Preservation of machinery.

Nantucket.—Preservation of machinery.

Nellie.—New condenser-tubes and minor repairs at the Mare Island navy-yard.

Nina.—New propeller; grate-bars; complete overhauling of engine; boilers retubed and repaired; piping repaired; minor repairs. The work was done at the New York navy-yard.

Nipsic.—Support for reversing gear and inner lining of smoke-pipe repaired. The work was done at the New York navy-yard. Smoke-pipe hoisting-gear repaired; changes in safety-feed, and minor repairs by force on board. Ship in continuous commission since October 10, 1887.

Omaha.—Minor repairs by shore parties. Continuous repairs to auxiliary boiler, and minor repairs incident to service by force on board. Ship in continuous commission.

Ossipee.—Reversing engines and bearings repaired; crank-pin brasses rebored and fitted with anti-friction metal; repairs to piping and heaters; new air and circulating pump valves; new air-pump rod; new propeller for launch and repairs to machinery. The work was done at navy-yards. Slight repairs to boilers; tubes of steam-launch boiler renewed; frequent repairs to steam-launch boiler. Minor repairs incident to continuous service. Ship in continuous commission.

Passaic.—Pistons removed; main wrist-pin trued and brasses rebored and fitted; crank-pin brasses fitted; boilers sealed; and minor repairs by engineer's force on board and at Naval Academy.

Palos.—Boilers partially retubed, and minor repairs by shore parties. Main valve reset; all outboard valves, pump-valves, distillers, and plungers of air and feed pumps overhauled; boilers scaled and leaky tubes renewed; and minor repairs by engineer's force on board. Ship in continuous commission.

Pinta.—New boiler built and old engine repaired for one steam-launch; new compound condensing engine and steel boiler built for other launch. The work was done at the Mare Island navy-yard. Repairs incident to continuous service by engineer's force on board. Ship in continuous commission.

Pensacola.—Partial repairs to boilers; steam-launch boiler, ash-hoister, cracked outboard delivery-pipe repaired; and minor repairs at New York navy-yard. Cracked ribs of steam ports of both cylinders repaired; new bearing-ring fitted to Waddell plate of after engine; new link block forward engine; engines thoroughly overhauled; and extensive minor repairs to boilers by engineer's force on board. Ship in continuous commission.

Phlox.—Minor repairs incident to continuous service. The work was done by the engineer's force at the Naval Academy.

Puritan.—Preservation of machinery.

Quinnebaug.—Repairs to back connections of boilers; changes in hand-hole plates of boilers; bottom blow connections renewed; boilers scaled; repairs to steam and drain pipes; new valves fitted in bilge-pump; auxiliary pumps thoroughly overhauled; steam-launch machinery repaired; new large bolts for equilibrium plate of high-pressure valve fitted; minor repairs to engines and boilers by engineer's force on board. Extensive repairs to boilers by shore parties. Ship in continuous commission.

Ranger.—High-pressure cylinder rebored; two new boiler steam-drums made and fitted; steam-launches repaired and one new propeller made and fitted; and thorough overhauling of engines and boilers. The work was done at the Mare Island navy-yard. Repairs incident to service, with one slight exception, by engineer's force on board. Ship in continuous commission.

Rescue.—New clothing for boiler and minor repairs incident to service. The work was done at the Washington navy-yard.

Richmond.—Keel-condenser of steam-launch repaired in part; out-board valves repaired; boilers thoroughly calked and a patch put in one furnace; minor repairs to piping and machinery. The work was done at the New York navy-yard. Repairs to ventilating-engine; main valves reset; new shaft, two new propellers, and new low-pressure piston fitted to steam-launches, and their engines and boilers repaired; calking boilers; minor repairs incident to service by engineer's force on board. Ship in continuous commission.

Rocket.—Small repairs incident to service made at the Boston navy-yard.

Speedwell.—Removed engines from vessel to store-house at the Norfolk navy-yard.

Standish.—New longitudinal braces for boilers made at the Norfolk navy-yard; scaled boilers; and minor repairs by engineer's force at Naval Academy.

Swatara.—Completed overhauling and repairing engines, boilers, auxiliary machinery, and heaters; new yoke made for reversing engine; pass-over valves repaired; leaks in boilers repaired. The work was done at the Portsmouth and Norfolk navy-yards. Cylinder-head of port blowing-engine repaired; crank-shaft brasses overhauled; minor repairs incident to a new commission after overhauling. Ship in commission since March 1, 1888.

Tallapoosa.—Gib for air-pump cross-head cast and fitted; high-pressure piston packing rings and journal brasses of steam-launch renewed, and minor repairs to boilers by engineer's force on board. Ship in continuous commission.

Terror.—Preservation of machinery.

Thetis.—Engines thoroughly overhauled; main valves reset; boilers repaired and new iron tubes put in; two new auxiliary boilers made. The work was done at the Mare Island navy-yard. Repairs to main and auxiliary boilers and steam-launch machinery; spare crank-pin brasses for forward engine fitted, and repairs incident to service by engineer's force on board. Ship in continuous commission.

Trenton.—New piston-rod for reversing-engine; high-pressure piston raised; composition bull-rings in low-pressure cylinder replaced by cast iron ones; white metal packing-rings for low-pressure piston-rods; composition cross-tail, high-pressure engine, replaced by steel one; main feed and bilge-pump valves and seats refitted and piping repaired; deflecting-plates for boilers; steam-trap and pipes to hot well fitted to dynamo separator; boiler leaks repaired; minor work and repairs. The work was done at the Norfolk and New York navy-yards. New cross-head pin and two braces for circulating-pump; minor repairs to copper pipes and valves of auxiliary pumps made by shore parties. Continuous scaling of auxiliary boilers and repairs incident to service made by engineer's force on board. Ship in continuous commission.

Vandalia.—New valve for main feed-pump; new valve-crank for starboard capstan engine; made one set of eccentric straps for launch engine. The work was done on shore. Smoke-pipe hoisting-gear repaired; made one set of eccentric straps for launch-engine; cemented bottoms of boilers; new sleeve in passage through outboard low-pressure cylinder-head to relief-valve; boilers scaled; minor repairs by engineer's force on board. Ship in continuous commission.

Vermont.—Minor repairs to steam-launch, fire-pump, auxiliary boiler on dock, and ferry scow. New boilers for heating to replace present ones are building.

Wabash.—Cutting down boilers and preparing new ones for use in ship; brazing tubes, and repairs to second auxiliary boiler at the New York and Boston yards. Starboard auxiliary boiler cut up and parts removed; and preservation of machinery by engineer's force on board.

Wyandotte.—Preservation of machinery.

Wyoming.—New cut-off valves and one new stem for same; adjusting and repairing valves and valve-gears; refitting brasses; and minor repairs by engineer's force on board and at the Naval Academy.

Yantic.—Extensive repairs to boilers; new boiler for steam-launch; cylinder counterbores chipped out; and minor repairs. The work was done at the Norfolk navy-yard. Repairs incident to service by engineer's force on board. Ship in continuous commission.

Cost of work done under cognizance of this Bureau for fiscal year ending June 30, 1888, upon machinery, boilers, etc., with outfits, stores, etc., of naval vessels; and the expenditures for maintenance, etc., at the several navy-yards and stations.

Name.	Machinery, boilers, etc.	Outfits, stores, etc.	Total.	Name.	Machinery, boilers, etc.	Outfits, stores, etc.	Total.
Adams	$518.00	$1,213.93	$1,731.93	Monongahela	....	$282.35	$282.35
Ajax	....	391.71	391.71	Montauk	$715.76	....	715.76
Alarm	629.52	....	629.52	Monterey	1,383.05	....	1,383.05
Alert	120.55	807.77	928.32	Nahant	738.70	....	738.70
Alliance	134.47	2,003.12	2,137.59	Nantucket	1,291.56	....	1,291.56
Atlanta	2,266.04	674.01	2,940.05	Nellie	294.73	....	294.73
Boston	9,458.25	2,637.11	12,095.36	Nipsic	8,847.44	9,913.85	18,760.29
Brooklyn	7,084.25	2,295.71	9,379.96	Nina	3,057.81	327.19	3,385.00
Catalpa	1,214.54	172.21	1,386.75	Omaha	28.85	1,009.70	1,038.55
Chicago	4,498.75	3,230.72	7,729.47	Ossipee	683.43	1,328.09	2,011.52
Cohasset	2,217.73	....	2,217.73	Palos	....	527.60	527.60
Despatch	996.46	953.49	1,949.95	Pinta	4,253.92	125.37	4,378.29
Dolphin	5,361.71	3,395.02	8,756.73	Pensacola	1,741.48	2,650.94	4,392.42
Enterprise	7,437.06	8,759.49	16,196.55	Pilgrim	....	63.75	63.75
Essex	4,197.60	1,557.27	5,754.87	Portsmouth	....	38.59	38.59
Fortune	7,841.36	487.00	8,328.36	Puritan	2,191.97	....	2,191.97
Franklin	131.42	645.75	777.17	Quinnebaug	2,469.60	1,883.06	4,352.66
Galena	10,026.82	1,981.88	12,008.70	Ranger	8,226.84	6.90	8,233.24
Hartford	8,313.42	....	8,313.42	Rescue	173.47	86.19	259.66
Intrepid	22.04	....	22.04	Richmond	1,543.59	1,807.31	3,350.90
Iroquois	6,345.36	2,300.15	8,645.51	Rocket, tug	437.68	100.08	537.76
Jamestown	195.77	12.92	208.69	Speedwell	361.30	....	361.30
Jason	764.80	....	764.80	Standish	3,720.18	....	3,720.18
Juniata	37.75	2,176.35	2,214.10	Swatara	37,800.51	1,348.45	39,148.96
Kearsarge	61,347.60	476.32	61,823.92	Saugus	23.02	....	23.02
Lancaster	203.79	4,338.67	4,542.46	Tallapoosa	41.80	3,116.02	3,157.82
Leyden, tug	943.78	....	943.78	Thetis	10,742.41	771.99	11,514.40
Marion	5,975.11	903.47	6,878.58	Trenton	12,325.29	11,945.17	24,270.46
Mayflower	1,228.56	504.03	1,732.59	Terror	1,274.94	....	1,274.94
Miantonomoh	3,640.41	....	3,640.41	Vandalia	....	856.04	856.04
Michigan	....	30.42	30.42	Vermont	3,352.55	699.15	4,051.70
Minnesota	177.68	1,349.16	1,526.84	Wabash	4,338.31	339.16	4,677.47
Mohican	45.00	1,106.02	1,151.02	Wyandotte	....	33.04	33.04
Monadnock	13.60	....	13.60	Yantic	8,406.19	1,249.02	9,655.21
Monocacy	266.37	....	266.37				

PRESENT CONDITION OF THE MACHINERY OF NAVAL VESSELS, WITH THE WORK REQUIRED ON EACH.

The following will show the present condition of the machinery of naval vessels and the work required to be done to fit them for efficient sea service, or to keep them on such duty during the next fiscal year, according to latest reports, with an approximate estimate of the cost of the same:

Adams (third-rate cruiser).—In commission on the Pacific station in good condition. Repairs incident to service, $500.

Ajax (single-turret monitor).—In ordinary at City Point, Va. Engines in fair condition. Would need new boilers and overhauling of engines to prepare for sea service at a cost of $40,000.

Alarm (torpedo ram).—In ordinary at the New York navy-yard. Could be made ready for sea service for about $1,800.

Alert (third-rate cruiser).—In commission on the Pacific station in good condition. Repairs incident to service, $500.

Alliance (third-rate cruiser).—In commission on the South Atlantic station in good condition, except boiler tubes, which are in fair condition. Repairs incident to service and new boiler tubes, $3,000.

Atlanta (second-rate partially-protected cruiser).—In commission on the North Atlantic station in good condition. Repairs incident to service, $1,000.

Boston (second-rate partially-protected cruiser).—In commission on the North Atlantic station in good condition. Repairs incident to service, $1,000.

Brooklyn (second-rate cruiser).—On return from Asiatic station under sail. On arrival, will need a new crank-shaft, new boilers, and general overhauling. Cost, including new boilers, about $80,000.

Camanche (single-turret monitor).—In ordinary at the Mare Island navy-yard. In good condition and could be made ready for about $2,000.

Canonicus (single-turret monitor).—In ordinary at City Point, Va. Engines in fair condition. Would need new boilers and general overhauling of engines to prepare for sea service at a cost of $10,000.

Catalpa (tug).—In service at the New York navy-yard. Boilers and machinery in good condition, but old. Repairs incident to service, $1,000.

Catskill (single-turret monitor).—In ordinary at City Point, Va., in good condition. Could be made ready for about $2,000.

Chicago (first-rate partially-protected cruiser).—At the New York navy-yard. Machinery has been tried successfully, and is in good condition. Cost of slight additions to outfit when going into commission, and repairs incident to service after commission, $2,000.

Cohasset (tug).—In service at the training station, Newport. Machinery has been overhauled, and is in good condition. Repairs incident to service, $500.

Dolphin (dispatch vessel).—In commission on the Pacific station in good condition. Repairs incident to service, $1,500.

Despatch (dispatch vessel).—In commission on special service on the Atlantic coast. Boilers in fair condition. Engines in good condition, but badly out of line; they require to be taken out and rebedded. This and minor repairs at a cost of $5,000.

Enterprise (third-rate cruiser).—In commission on the European station in good condition. Repairs incident to service, $500.

Essex (third-rate cruiser).—In commission on the Asiatic station. Engines in fair condition. Will need new boilers at the end of the present cruise. Cost, $50,000.

Fortune (tug).—In commission on special service along the Atlantic coast. Engines have been overhauled and are in good condition, and boilers in fair condition. Repairs incident to service, $500.

Franklin (old type frigate).—Receiving-ship at the Norfolk navy-yard. Boilers have been condemned.

Galena (third-rate cruiser).—In commission on the North Atlantic station; has been in continuous commission since she was built, and is a very serviceable vessel; requires general overhauling and repairs to engines, with new crank-shaft and new boilers, at a cost of $65,000.

Hartford (second-rate cruiser).—At the Mare Island navy-yard. Engines require extensive repairs; new boilers needed; the material for these boilers is on hand and the boilers partly constructed. The cost to put vessel in condition for sea would be $75,000. It has not yet been decided whether the vessel is to be repaired or not.

Intrepid (torpedo ram).—At the New York navy-yard. The boilers were taken out to permit of alterations to hull. It is doubtful if the hull will be launched again. At an expense of about $25,000 the engines and boilers might be adapted to a light-draught river gun-boat, such as is needed for Chinese waters.

Iroquois (third-rate cruiser).—Machinery being overhauled at Mare Island navy-yard. Estimated cost to complete repairs, $10,000.

Jason (single-turret monitor).—In ordinary at the League Island navy-yard. In good condition. Machinery could be got ready in one month's time at a cost of $2,000.

Juniata (third-rate cruiser).—Returning from the Asiatic Station. Will require thorough overhauling of engines, new main and auxiliary boilers, at an estimated cost of about $65,000.

Kearsarge (third-rate cruiser).—Repaired at the Portsmouth navy-yard. The old engines have been replaced by those of the old *Nantasket*, and four new cylindrical boilers, fitted with forced draft, have been put in. Is ready for sea service. Repairs incident to service after commission, $1,000.

Lancaster (second-rate cruiser).—In commission on the European station. Engines need repairs. Boilers are in very bad condition, and will soon have to be replaced. Cost of repairs, including boilers, $80,000.

Lehigh (single-turret monitor).—In ordinary at City Point, Va. In good condition. Machinery could be got ready for $3,000.

Leyden (tug).—In service at the Portsmouth navy-yard. Machinery requires complete overhauling, at a cost of about $5,000.

Mahopac (single-turret monitor).—In ordinary at City Point, Va. Machinery in good condition. Could be made ready for $1,000.

Manhattan (single-turret monitor).—In ordinary at City Point, Va. Machinery in fair condition. Could be made ready for $1,000.

Marion (third-rate cruiser).—In commission on the Asiatic station. Machinery in fair condition. Repairs incident to service, $2,000.

Mayflower (tug).—In use at the Norfolk navy-yard. In good condition. Repairs incident to service, $1,500.

Michigan (fourth-rate paddle-wheel steamer).—In commission on the Great Lakes. Machinery in good condition. Repairs incident to service, $2,000.

Miantonomoh (two-turret monitor).—At the New York navy-yard awaiting turrets. Machinery will require cleaning and adjusting before being in condition for sea service, the turret engines put in place and connected, the heating apparatus put in order, and the repairs consequent upon the changes made in the hull, at a cost of $12,000.

Minnesota (old-type frigate).—Receiving-ship for boys, at New York. Boilers are worn out. The condition of the hull will not warrant any outlay on the machinery.

Mohican (third-rate cruiser).—In commission on the Pacific station. Engines, boilers, launch, and auxiliary machinery to be thoroughly overhauled and repaired. The work will be done at the Mare Island navy-yard, at an estimated cost of $20,000.

Monocacy (third-rate paddle-wheel steamer).—In commission on the Asiatic station. Engines and boilers in fair condition. Minor repairs needed. Repairs incident to service, $1,000.

Montauk (single-turret monitor).—In ordinary at League Island navy-yard. In good condition. Could be got ready for $2,000.

Monterey (tug).—In service at the Mare Island navy-yard. Repairs incident to service, $500.

Nahant (single-turret monitor).—In ordinary at the League Island navy-yard. Machinery in good condition. Could be made ready in one month's time at a cost of $2,000.

Nantucket (single-turret monitor).—In ordinary at the New York navy-yard. Machinery in good condition. Could be made ready for $2,000.

Nellie (tug).—In service at the Mare Island navy-yard. Repairs incident to service, $500.

Nina (tug).—In service at the New York navy-yard. Repairs incident to service, $500.

Nipsic (third-rate cruiser).—In commission on the Pacific station. Machinery in good condition, except cracked feed and bilge-pump chambers. Repairs incident to service, $2,500.

Omaha (second-rate cruiser).—In commission on the Asiatic station. Machinery in good condition, except auxiliary boiler, which is nearly worn out, and will have to be renewed on the station. Cost of repairs incident to service, including new auxiliary boiler, $5,000.

Ossipee (third-rate cruiser).—In commission on the North Atlantic station. Machinery undergoing repairs at the Norfolk navy-yard. Estimated cost of repairs, including a new boiler for steam-launch, $3,500.

Palos (fourth-rate steamer for coast and river service).—In commission on the Asiatic station. Machinery and boilers have been put in a fair state of repair, and are probably good for one and a half years' more service. Repairs incident to service, $2,000.

Pinta (similar to *Palos*).—In commission on the Pacific station. Machinery needs general overhauling. Estimated cost, $5,000.

Passaic (single-turret monitor).—In service at the Naval Academy. Machinery is in sufficiently good order for present use, but should be overhauled if required for sea service. Cost, $1,500.

Pensacola (second-rate cruiser).—In commission on the North Atlantic station. Machinery being thoroughly overhauled and repaired at the Norfolk navy-yard, and two new main boilers built for the *New York*, and one cylindrical boiler for auxiliary purposes, being put in. Estimated cost of repairs, including cost of new boilers already built, $75,000.

Phlox (paddle-wheel steamer).—In service at the Naval Academy. Engines in fair condition. Will soon require a new boiler and general overhauling of machinery, at a cost of about $4,000.

Quinnebaug (third-rate cruiser).—In commission on the European station. The boilers have again been repaired, but will not last much longer. This ship has been kept in continuous commission ever since she was built, about ten years ago, and has not been properly overhauled since. More money has been spent in a patchwork sort of way than would have sufficed to give a thorough overhauling. Her machinery should be repaired at a navy-yard without delay, if the condition of the hull should warrant any outlay. Estimated cost of extensive repairs to engines, with new boilers, $40,000.

Ranger (third-rate cruiser).—In commission, on surveying service on the Pacific coast. In good condition. Repairs incident to service, $500.

Rescue (tug).—In service at the Washington navy-yard. Machinery in fair condition. Should defects occur, it is doubtful if the condition of the hull will warrant any outlay for repairs. Repairs incident to service, $300.

Richmond (second-rate cruiser).—In commission, and preparing for service on the Asiatic station. Machinery in good condition, and will be ready for sea after vessel has been docked, outboard valves examined, and propeller blades straightened. Repairs incident to service, $1,200.

Rocket (tug).—In service at the Boston navy-yard. Engines in good condition. Water legs of boilers corroded. Estimated cost of repairs, $1,500.

Speedwell (tug).—In ordinary at the Norfolk navy-yard. Will need new boilers and a new crank-shaft if the vessel is to be again put in service. Estimated cost of repairs, $25,000.

Standish (tug).—In service at the Naval Academy. In good condition. Repairs incident to service, $500.

Swatara (third-rate cruiser).—En route to the South Atlantic station. Machinery has been overhauled. Repairs incident to service, $1,000.

Tallapoosa (third-rate paddle-wheel steamer for river service).—In commission on the South Atlantic station. Machinery in fair condition. Repairs incident to service, $500.

Terror (two-turret monitor).—At the New York navy-yard. The main engines and boilers are in good condition, but to fit them for sea service, lagging boilers and cylinders, machinery for steam-launch, and minor repairs, will cost about $10,000. The cost of pneumatic turret turning-gear is not included in the above estimate.

Thetis (third-rate vessel for special service).—In commission for special service on the Pacific coast. Main boilers and engines have been overhauled and a new auxiliary boiler for distilling and heating has been put in. Repairs incident to service, $1,000.

Trenton (second-rate cruiser).—In commission on the Pacific station. In good condition. Repairs incident to service, $1,500.

Triana (tug).—In service at Newport. No report on condition of machinery received.

Vandalia (second-rate cruiser).—In commission on the Pacific station. Slight repairs needed at a cost of $4,000.

Wabash (old-type frigate).—Receiving-ship at the Boston navy-yard. Engines and boilers condemned. It will not pay to put in new machinery.

Wyandotte (single-turret monitor).—In ordinary at City Point, Va. Could be made ready for $4,000.

Wyoming (third-rate cruiser).—In service at the Naval Academy. Needs slight repairs for present service at a cost of $500.

Yantic (third-rate cruiser).—In commission on the North Atlantic station. General repairs to engines and boilers have been made at the Norfolk navy-yard, which will probably enable the boilers to last during this year. Repairs incident to service, $700.

MACHINERY UNDER CONSTRUCTION FOR NEW VESSELS.

The state of work done up to October 15 on the machinery of vessels contracted for during the last fiscal year is as follows:

NEWARK (Crusier No. 1).—Machinery designed by the contractors, William Cramp & Sons, Philadelphia, Pa. Twin-screw, horizontal, triple-expansion engines of 8,500 I. H. P.; cylinders 34, 48, and 76 inches diameter, by 40 inches stroke; piston-valves and radial valve-gear of the Marshall type; built up crank-shafts, each in one piece, with cranks at angles of 120° with each other; cylindrical sheet-brass condensers, each with 6,250 square feet of condensing surface; independent air and circulating pumps. Four cylindrical double-ended boilers, each with three 43-inch furnaces at each end, each furnace having a back connection in common with the opposite furnace; diameter of boilers, 13 feet 6 inches; length, 19 feet 6 inches; grate surface, 540 square feet; heating surface, 15,650; closed stokehold system of forced draft; one auxiliary two-furnace boiler, 8 feet 6 inches diameter and 8 feet 3 inches long; furnaces 32 inches diameter and 5 feet 10 inches long; steam-pressure of main and auxiliary boilers, 160 pounds; screw-propeller 14 feet 6 inches diameter. Machinery under contract to be finished within two years from October 27, 1887.

Patterns for low-pressure cylinders are completed, and those for the intermediate cylinders and the bed-plates are nearly completed. Some of the boiler-plates are on hand, bent, flanged, and drilled.

The following changes in design have been proposed by the contractors and approved:

Diameter of intermediate cylinder increased from 48 to 52 inches.
Crank-shaft pillow-block frames made in two pieces instead of four.
Cross-head guides to be hollow, and of cast-iron, instead of steel bar.
Surface-condensers to be made of cast-brass instead of sheet brass.
Circulating pumps to be of the centrifugal type, instead of reciprocating.
Two air-pumps and two bilge-pumps for each engine instead of one.
Centrifugal bilge-pump to be omitted.
Fire and bilge pumps in engine-room to be horizontal instead of vertical.

PHILADELPHIA (Cruiser No. 4).—Machinery designed by the contractors, William Cramp & Sons, Philadelphia, Pa. Twin-screw, horizontal, triple-expansion en-

gines of sufficient power to drive the ship at a speed of 19 knots per hour. Cylinders 38, 56, and 83 inches diameter by 40 inches stroke; piston-valves and radial valve-gear of the Marshall type; crank shafts built up, each in one piece with cranks at angles of 120° with each other; cylindrical sheet-brass condensers, each with 6,750 square feet of condensing surface; independent air and circulating pumps. Four cylindrical double-ended boilers, with four 36-inch furnaces at each end, each furnace having a back connection in common with the opposite furnace; diameter of boilers 14 feet, length 19 feet 11 inches; grate surface 624 square feet; heating surface 20,458; closed stokehold system of forced draft. One auxiliary 2-furnace boiler 8 feet 6 inches diameter and 8 feet 3 inches long; diameter of furnaces 32 inches, length 5 feet 10 inches. Steam pressure of main and auxiliary boilers 160 pounds. Screw propeller 14 feet 6 inches diameter. Machinery under contract to be finished within two years from October 27, 1887.

One high and one low-pressure cylinder have been cast, and the latter bored for the lining. The connecting rods and some details of the valve gear have been forged, and the crank-shaft brasses cast.

The following changes in design have been proposed by the contractors and approved:

Diameter of intermediate cylinder increased from 56 to 58 inches.
Surface condensers to be made of cast brass instead of sheet brass.

SAN FRANCISCO (Cruiser No. 5).—The design of the machinery for this vessel as submitted to and accepted by the contractors was that of the *Baltimore*, designed by Humphrys, Tennant & Co., Deptford, England. A new design, of which the following are the principal features, was subsequently submitted by the contractors and approved by the Department:

Twin-screw, horizontal, triple-expansion engines of sufficient power to drive the ship at a speed of 19 knots per hour. Cylinders, 42, 60, and 94 inches diameter by 36 inches stroke; all cylinders steam-jacketed; piston-valves for the high and intermediate-pressure cylinders and double-ported slides for the low pressure, all worked by Stephenson double-bar link-motion; engine framing and pillow-blocks of forged steel; crank-shafts each made in interchangeable sections; cylindrical sheet-brass condensers, each with 7,276 square feet of condensing surface; independent air and circulating pumps; four cylindrical double-ended boilers, 14 feet 8 inches diameter and 19 feet 2 inches long, each boiler having six 42-inch furnaces, and each furnace having a separate back connection; grate surface 560 square feet; heating surface 19,480; closed ash-pit system of forced draft. One auxiliary boiler, 8 feet diameter and 8 feet long; grate surface, 16 square feet; heating surface 450 square feet; steam pressure of main and auxiliary boilers, 135 pounds; screw propeller, 14 feet 3 inches diameter. Machinery under contract to be finished within two years from October 26, 1887.

Both high-pressure and one intermediate cylinder and all cylinder-linings have been cast, lining secured in one high-pressure cylinder, and finishing cut taken. The mold has been made for second intermediate cylinder, and patterns for low-pressure cylinders, high-pressure and intermediate pistons and cylinder-covers, intermediate valves, and for bonnets for outboard ends of intermediate valve-chests. Steel bolts for reversing-shaft brackets and other details have been forged.

Since the acceptance of the design the following changes have been proposed by the contractors and accepted:

Valve-motion rock-shafts to be made with arms forged on instead of keyed.
Link suspension rods to have adjustable brasses instead of solid ends bushed.
Valve gear connecting-links to be of forged instead of cast steel, and to be made double instead of forked.
Blower-engines to be compound instead of simple.
Rotative feed-pumps instead of direct-acting.
Propeller-shaft outboard coupling flanges to be made by welding a ring on, instead of being forged solid.
Stern sleeve to be of forged instead of cast steel.
Slight change in spacing of boiler braces.
Piston-shoes of cast-iron instead of cast steel.
Position of cylinder relief valves changed.
One exhaust-pipe instead of two from high-pressure to intermediate valve-chest.
Throttle to be operated by a steam cylinder instead of by hand wheel.
Low-pressure valve-chest modified so that exhaust steam goes between valves instead of outside.
Guides for valve-stems added.
Steam-reversing gear to be horizontal instead of vertical.

CONCORD (Gunboat No. 3).—The machinery is a duplicate of that of the *Yorktown*, except that the crank-shaft is to be built up instead of forged in one piece, and minor

differences in detail. The contract was awarded November 15, 1887, and the machinery is to be completed May 15, 1889.

The cylinders and linings have been cast, and the latter secured in place: the cylinder covers, valves, and valve liners have been cast, and work on them is well advanced; the connecting-rods and tie-rods are forged and nearly completed; the crank-pin and crank-shaft brasses have been cast, and some of them lined with white metal; the thrust and line shaft bearings, and the injection and outboard delivery valves are completed; the stern tube bushings have been cast, and are being planed; the reversing engines are nearly completed; the bed-plates have been cast, and one set of engines is in course of erection in the shop; the details of valve gear are well advanced, and about one-half of the shafting is being turned and bored. Material for the boilers has been received, and the work is in a forward state.

BENNINGTON (Gunboat No. 4).—Machinery is a duplicate of that of the *Concord*. The state of work on the engines is the same as for the *Concord*. Two of the boilers are nearly completed, two more are well advanced, and the plates for the others are being bent, planed, and drilled.

The state of work on the machinery of the vessels reported upon in my last annual report is as follows:

CHARLESTON (Cruiser No. 2).—The work on the engines of this vessel is practically completed in the shop, and they are now in course of erection on board. Four of the main boilers are completed, and are in the ship; the other two require only the longitudinal braces for completion. The auxiliary boiler and the uptakes and furnace fronts of the main boilers are nearly completed, and work has been started on the smoke-pipe. The contractors report that the vessel will be ready for trial in December.

The following changes in design, in addition to those enumerated in my last annual report, have been proposed by the contractors and approved:

Spacing of boiler tubes slightly reduced in order to get in the required number of tubes.

Number of wildcats on windlass reduced from four to two.

Thrust rings of phosphor bronze instead of composition; spare set of composition.

Eccentric straps and levers of forged instead of cast steel.

Piston-valve packing rings reduced in width, and steel substituted for cast-iron and Perkins's metal.

Tobin's metal bolts made with a smaller percentage of tin than specified, in order to facilitate working.

Vertical braces of combustion chambers enlarged at eye, and bolts and nuts substituted for split pins.

Staying of low-pressure steam-ports changed from ribs to screw-stays.

Cylinder and pipe lagging to be teak instead of black walnut.

Auxiliary condenser, evaporator, and forced draft appliances for auxiliary boiler added on account of auxiliary boiler being too small for its work.

Furnace of auxiliary boiler strengthened by an Adamson ring.

Steam and reversing valves of steam windlass to be slide instead of piston valves.

Entirely new design of air-pumps after those of the original design had been nearly completed. This change was necessary on account of the small capacity of the pump in the original design, and the reports of the poor performance of the air-pumps of vessels fitted with machinery built from the same designs, the contractors expressing doubt about being able to maintain the required vacuum. In the new design a double-acting plunger is substituted for a single-acting bucket plunger.

Engines to be bedded on cast-iron instead of on wood.

Change in method of securing boilers in ship on account of saddles being too large for boilers.

Condensers to be clothed with non-conducting material.

BALTIMORE (Cruiser No. 3).—The propeller shafts, outboard delivery and injection valves, main circulating pumps and engines, fire and bilge pumps, main and auxiliary feed pumps, auxiliary air and circulating pumps and engines, and auxiliary condenser, are finished and in place on board ship. The crank, thrust and intermediate shafts, line-shaft pillow-blocks, and condensers are finished and ready to go in place. The main and auxiliary boilers are ready for testing, and the uptakes and furnace fronts are well advanced. The cylinders, engine framing, crank-shaft pillow-blocks, and diagonal stays are completed and erected in the shop, the valve faces in place, and crank-shaft brasses ready for boring. The pistons and rods are nearly completed, and the air-pumps ready for erecting. Work on the connecting rods, valves, and valve gear, reversing engines and gear, and thrust bearings, is well advanced.

The following changes in design, in addition to those enumerated in my last annual report, have been proposed by the contractors and approved:

Crosshead slippers made in two pieces, and bearing-surface increased.

Condenser tube sheets changed from one plate of composition to two of Muntz metal united by scarph joint, on account of difficulty of getting a good casting.

Capstan stepped from one end of windlass bed instead of near center.

Details of crank-shaft pillow-block frames (cast steel) changed to facilitate casting, the third attempt having proved a failure.

Position of outboard delivery valve changed in order to clear a butt strap on outer plating.

Air-pump piston rods of Muntz metal instead of naval brass.

New design of thrust block provided with means of water circulation.

Changes in feed tank made necessary by the introduction of gussets on ship's side to strengthen hull.

Slight change in one low-pressure valve-chest to correct error in casting.

Two additional holes cut in caps of low-pressure crank-shaft pillow-blocks to correct error and agree with holes in brasses.

Low-pressure valve-chest covers of cast-iron instead of cast-steel, on account of impossibility of getting sound castings.

YORKTOWN (Gun-boat No. 1)—The engines, boilers, and auxiliary machinery, with the exception of a few details, are completed and erected on board, but the boilers have not yet been clothed. Preliminary dock trials have been made.

The following changes in design, in addition to those enumerated in my last annual report, have been proposed by the contractors and approved:

Smoke-pipe to have a double instead of a single shell, dampers at bottom of uptake instead of near top, and pipe to be divided into two parts instead of four above dampers.

One low-pressure valve-motion rock-shaft of wrought iron instead of cast-steel, on account of difficulty of getting good castings.

Combined check and stop-valves on boilers instead of two separate checks.

Cylinder-heads to be of cast-iron, as originally specified, instead of cast-steel, as allowed.

PETREL (Gun-boat No. 2).—The engines, with the exception of a few minor details, are practically completed, and are being erected in the shop. The boilers and smoke-pipe are completed, and work on the uptakes and pipes is progressing favorably. The propeller shaft, stern-tube, and stuffing-box, and the sea valves are finished and in place on board.

The following changes in design, proposed by the contractors, have been approved:

Furnaces made in two lengths, welded, instead of in one.

Hand-wheel of main stop-valve of composition instead of wrought iron.

Air-pump barrel cast separate from casing.

Screw propeller of aluminum bronze instead of manganese bronze.

Change in method of fitting boiler braces.

VESUVIUS.—The machinery is in place on board, and has been tried by the contractors.

MONADNOCK.—New machinery for this vessel has been designed by the Bureau, material advertised for, and work commenced at the Mare Island navy-yard. The design is for twin-screw, horizontal, triple-expansion engines of 3,000 I. H. P., each engine, and each pair of boilers being in a separate water-tight compartment. Cylinders 19¾, 30¼, and 52¾ inches diameter by 30 inches stroke; piston valves worked by Stephenson link-motion; steel crank-shafts, each made in interchangeable sections; cylindrical sheet-brass condensers, each with 2,485 square feet of condensing surface; independent horizontal air-pumps, and centrifugal circulating pumps. Four cylindrical return-tubular boilers, each with two 46-inch furnaces; diameter of boilers, 12 feet 2 inches; length, 10 feet 1 inch; total grate surface, 200 square feet; total heating surface, 6,212 square feet; closed ash-pit system of forced draft; steam pressure, 160 pounds; weight of machinery, including water in boilers and condensers, 354 tons.

The stern tubes and propeller-shafts as originally designed being in place, the new design was somewhat restricted in order to preserve the same shaft lines.

The old design of machinery for this vessel was for inclined two-cylinder compound

engines of 1,600 I. H. P., both engines being in the same compartment, and all the boilers in one compartment; weight of machinery, including water in boilers and condensers, 547 tons.

Thus, by the use of higher pressure, increased piston speed, forced draft, and better materials, there has been a saving in weight of 193 tons, and also a saving in space occupied by the boilers, there being only four in the new design, while in the old one there were six of the same size; besides which the horse-power has been increased from 1,600 to 3,000, which will increase the speed of the ship at least two knots. The saving in weight and the reduction of the number of boilers will allow an increase either in the amount of coal carried, or a corresponding increase in armament or ammunition.

TERROR.—The machinery has been tested and accepted. The principal work remaining to complete the machinery is the turret-turning gear, and covering the boilers. The boiler covering was omitted, owing to the probability of its rotting while the vessel is laid up awaiting her turrets, armor, and guns.

AMPHITRITE.—The machinery has been tested, but owing to the intense heat of the fire-rooms, due to the boiler clothing having been omitted for the same reason as in the *Terror*, the trial had to be discontinued after sixteen hours' duration.

NAVY-YARDS.

The work of the Bureau in the navy-yards during the past year has consisted principally in repairs to existing machinery of naval vessels, and putting in boilers already built. The only yard where new machinery is building is that at Mare Island, where the machinery for the *Monadnock* has been begun.

In order to be prepared for any emergency, when the navy-yards would be called upon to build machinery rapidly, I would recommend additions to the shop buildings and tools as noted below in detail.

The machinery most needed at navy-yards to bring them up to modern requirements is in the way of boiler-making plant, capable of dealing with the heavy plates required by high steam pressures.

I would renew my recommendation of last year that a large proving and testing machine be built at the New York yard, with appliances for proving all parts which enter into marine engines, including crank-shafts. A similar machine should also be erected at Mare Island, Cal., as there is no such machine on the Pacific coast.

I would also renew my recommendation that a central steam-generating plant be started in each principal navy-yard, and gradually added to, as the present boilers, scattered in various parts of the yard, become unfit for use.

From this central station steam could be conducted to the various points where large powers are needed, and electricity to places where small motors are wanted. The dynamos of this station could also be used for lighting the yard and the dark parts of vessels undergoing repairs. It would be found that the running expenses would be thus greatly reduced and danger from fire much diminished. I would recommend that $20,000 be appropriated to begin such central stations at each of the navy-yards at New York, Portsmouth, Norfolk, and Mare Island.

A synopsis of the principal work done at the various navy-yards, together with an account of the expenditures at each yard, other than for work done on naval vessels, will be found below. A list of machine tools which I would recommend to be added during the coming year is also given, with an estimate of cost.

NEW YORK NAVY-YARD.

At this yard during the last fiscal year work in the way of preservation, overhauling, and repairs was done on the machinery of the *Alarm*,

Atlanta, *Boston*, *Despatch*, *Dolphin*, *Catalpa*, *Chicago*, *Cohasset*, *Enterprise*, *Fortune*, *Galena*, *Intrepid*, *Leyden*, *Minnesota*, *Miantonomoh*, *Nantucket*, *Nipsic*, *Nina*, *Ossipee*, *Portsmouth*, *Pensacola*, *Richmond*, *Trenton*, and *Vermont*, as elsewhere noted in connection with these vessels.

Work was done on machinery and stores and shipped to the following vessels: *Brooklyn*, *Kearsarge*, *Marion*, *Omaha*, *Tallapoosa*, and *Wabash*.

A number of steam-launches were overhauled and repaired.

The work done for the other Bureaus was briefly as follows:

Ordnance.—Pipe work on training-engines of the *Boston*, pipe work on search-light dynamo engine and steam-launch dynamo of the *Chicago*.

Yards and Docks.—Made castings for derrick; repaired derrick-engine; tubed boiler and cast hammer and winches for pile-driver; repaired boiler and made new connections; repaired old and made new exhaust-pipe; refitted piston, repaired smoke-pipe, straightened air-pump piston-rod, cast grate-bars, and made minor repairs on pumping machinery of the dry-dock; made miscellaneous castings for iron derricks for dry-dock; repaired boiler in dry-dock stone-shed; repaired hoisting-engine boiler.

Navigation.—Made various castings, and making deck-plates for binnacles and sounding-machines; made changes in piping of dynamo engine of the *Atlanta*, *Boston*, and *Trenton*; made all connections to dynamo engines of the *Chicago*.

Equipment and Recruiting.—Galley work for the *Jamestown*; making turnbuckles; repairing canvas-testing machine; repairing boilers and engine; completing boiler for cob-dock.

Medicine and Surgery.—Repairs to two boilers at the naval hospital.

Provisions and Clothing.—Repairs to engines, boilers, and feed-water heater.

Construction and Repair.—Made various articles of cast-iron and composition, such as stanchions, cleats, shoe for forefoot of the *Nipsic*, man-hole plates for the double bottom of the *Atlanta*, castings for the steering-gear of the *Dolphin*, pinions and wheels, scupper drips, expanding tubes in boiler, repairs to shop-boilers, normans for the *Boston*, hawse-pipe covers, sheaves, tracks for guns, blue print frame, railings, grate-bars, clamping-bars for Hotchkiss towers of the *Boston*, and anchors for life-buoys. Use of floating derricks for hoisting boats and various other purposes. Made three boilers for new shops.

The following machine-tools were added to the Bureau's shops during the year:

One testing-machine.
One plate-planing machine.
One riveting-machine.
One shearing-machine.
One set flange-blocks.
One flange punch.
Twelve rivet-forges.
One leather-shaving machine.

The lathes, planers, slotters, and other tools in the machine, pattern, boiler, and copper shops were thoroughly overhauled. The cranes in the foundry were taken apart, cleaned, and repaired where needed.

The machine-shop at this yard is not adapted to the proper handling of heavy work or to the erecting of large engines without loss of time. The original plan of the shop included a wing for the heavier machine-tools, and to be used as an erecting-shop. This wing should be built and fitted with large overhead traveling cranes. An erecting floor

should be built and the heavier machine-tools moved out of the present shop to make room for the tools that are needed there.

I would recommend that an appropriation be asked for to purchase the following tools, in order to put the shop in condition to handle work more rapidly and with greater economy than at present:

One vertical boring, turning, and facing machine	$25,000.00
One screw-cutting lathe, 72 inches swing and 50 feet centers	7,600.00
Two lathes, 17½ inches swing	1,700.00
Two lathes, 20½ inches swing	2,250.00
Two lathes, 26½ inches swing	3,050.00
One surface-grinding machine	800.00
One tool-grinder	300.00
One shaft-straightening machine	1,000.00
One hydraulic flanging-machine	5,500.00
One accumulator	1,600.00
One hydraulic pressure-pump	1,000.00
One hydraulic bending-press for heavy boiler-plates	10,000.00
One boiler-shell drilling-machine	1,500.00
One overhead traveling crane for new boiler-shop	20,000.00
One 600-ton proving and testing machine	30,000.00
One overhead traveling crane for the foundry	20,000.00
Cost of setting the above machines, foundations, pipes, etc., and line-shafting for the new boiler-shop	25,000.00
Total	156,300.00

The expenditures of the Bureau at this yard, other than those for work done on the machinery of naval vessels, are as follows:

Civil establishment	$5,495.55
Office expenses	879.68
Handling stores	5,860.19
Care and repair of and additions to shop tools	53,845.54
Running and firing yard engines and boilers, and repairs to same	8,712.78
Repairs and maintenance of yard steam-launches and ferry	2,032.70
Repairs to old derrick	1,894.32
Completing new floating derrick	34,941.30
Preservation of machinery	4,545.92
Machinery and stores shipped to other stations	5,677.28
Experimental purposes	1,955.02
Handling coal and lumber	1,025.08
Draughting material	294.63
Removing material from site of new dry-dock	2,967.32
Breaking up old material	848.86
Repairing stores	122.50
Incidental expenses	5,304.65
Holidays	3,374.37
Commandant's barge	2,583.04
Miscellaneous	3,254.64
Total	145,615.37

PORTSMOUTH NAVY-YARD.

During the last fiscal year the repairs on the boilers and machinery of the *Swatara* were completed, and minor repairs made on the machinery of the *Ossipee*. Completed the repairs to the machinery and boilers of the *Kearsarge*, new boilers having been fitted and the *Nantasket's* engines thoroughly overhauled, erected on board, and new steam-pipes and heaters fitted.

Building machinery for ferry launch for training station. Repairs were made on the machinery and boilers of the *Leyden* and *Emerald*.

Work was done for other Bureaus as follows:

Yards and Docks.—Made small castings, such as grate-bars, gas-retorts, etc.

Navigation.—Repaired deep-sea sounding-machine.

Construction and Repair.—Tested boilers and made castings for boilers at saw-mill.

The following tools are recommended to be added to the plant:

One turret-head bolt-cutting machine	$340.00
One horizontal nut-tapper	
Eighteen assorted lathe chucks	[illegible]
One band-saw	225.00
One wood-turning lathe	250.00
Total	1,600

The expenditures at this yard for the year, other than those for w done on naval vessels, are as follows:

Civil establishment	$2,264.90
Experimental work	56.95
Handling stores	1,418
Care and repair of shop machinery	9,763.[illegible]
Running, firing, and repairing yard-engines and boilers	2,393.44
Care and repair of boilers and machinery of yard steam-launches	350.56
Stores for issue, and care of same	422.34
Steam-boilers and machinery for launches for general service	6,635.77
Holidays	1,505.17
Miscellaneous	4,759
Total	29,574.50

NORFOLK NAVY-YARD.

During the last fiscal year the machinery of the *Fortune* was thoroughly overhauled, and a new air-pump, surface condenser, and centrifugal circulating pump fitted. The engines and boilers of the *Galena* were extensively repaired. Minor repairs were made on the machinery of the *Ajax*, *Despatch*, *Franklin*, *Jamestown*, *Lancaster*, *Mayflower*, *Ossipee*, *Standish*, *Swatara*, *Trenton*, *Yantic*, and *Wyandotte*.

The old boilers have been removed from the *Pensacola*, and two rectangular boilers, with one cylindrical auxiliary boiler, are being placed on board, and the machinery is being thoroughly overhauled.

The work done for other Bureaus was, briefly, as follows:

Ordnance.—Repaired tram-car and made composition wood-screws and elevating screw.

Construction and Repair.—Miscellaneous castings, such as grate-bars, melting-pots, life-buoy anchors, and bending furnace; built two boilers for ship-fitting house.

Yards and Docks.—Repaired boilers, cast grate-bars, and made castings for large crane.

Medicine and Surgery.—Repaired boilers at the Naval Hospital.

The following machinery was added to the shop plant during the year:

One large key-way cutting machine.

One shaping machine.

One emery grinding machine.

One slide lathe.

One hydraulic riveting machine for driving rivets up to 1 inch diameter.

The steam engineering buildings at this yard are old and badly adapted to modern machine-shop practice. A new building should be erected to be used as an erecting shop and for the heavier tools, and fitted with traveling cranes and other modern appliances, leaving the

present machine-shop to be used for the lighter work. A number of tools that are needed can not be got into the present shops.

The following tools, which can be put into the present buildings, should be added to this plant to facilitate rapid and economical work:

One screw-cutting engine lathe to swing 60 inches, 50 feet centers	$6,000
Two emery tool grinders	590
One 24-inch pattern-maker's lathe, 16 feet long	255
One boiler-drilling machine	1,500
One hydraulic flanging machine	5,500
One hydraulic plate-bending machine	10,000
One hydraulic overhead crane for riveting machine	4,350
One hydraulic accumulator	1,600
One hydraulic pressure-pump	1,000
Iron platform and elevator for cupolas in foundry	3,000
And various small tools amounting to	1,000
Cost of setting the above machines, foundations, pipes, shafting, etc	15,000
Total	49,795

The expenditures of the Bureau at this yard, other than for repairs to machinery of naval vessels, are as follows:

Civil establishment, clerks	$1,329.45
Draughting	1,323.05
Writers, messengers, receivers, etc	648.00
Handling stores	3,610.66
Superintendence of shops	1,670.49
Care and repair of shop tools, and additions to same	14,848.74
Running and firing yard engines and boilers	7,951.20
Repair to yard engines and boilers and additions to same	1,792.34
Draughting materials	209.37
Care and repair of machinery of yard steam-launches	3,141.80
Tests and trials of machinery	230.01
Melting down old material	6.26
Preservation of stores	3,860.62
Building and repairing steam-launch boilers for general purposes	8,652.02
Building and repairing steam-launch engines for general purposes	5,358.69
Holidays	1,435.06
Surveys	500.76
Shipping stores	23.55
Total	56,591.47

MARE ISLAND NAVY-YARD.

During the last fiscal year the engines and boilers of the *Thetis* were overhauled. Repairs were made to the machinery of the *Camanche*, *Iroquois*, *Lively*, *Nellie*, *Monterey*, *Ranger*, and two launches for the *Pinta*.

Repairs were also made to the machinery of the U. S. R. S. *Rush*, U. S. Coast Survey steamers *McArthur* and *Patterson*, and the machinery and boilers of the U. S. Light-House steamer *Manzanita*.

The work done for other Bureaus was, briefly, as follows:

Yards and Docks.—Cast-iron and composition castings, such as truck-wheels, grate-bars, man-hole plates, and miscellaneous work.

Navigation.—Brass blocks.

Construction and Repair.—Miscellaneous cast iron and composition castings.

Medicine and Surgery.—Small castings.

Equipment and Recruiting.—Repairs, and galleys, etc.

The only addition to the machinery of the shops was a 15-ton crane in the machine-shop. A new building is badly needed for the rolling-mill machinery, which is now nearing completion. This machinery will

be very useful in working up, at little expense, the scrap material which is now as good as wasted.

The following machines should be added to this plant to facilitate rapid and economical work:

One universal milling machine	$800
Two radial drilling machines	1,680
Two lathes	1,300
Two slotting machines	3,200
Two planing machines	5,375
One emery-wheel surfacing machine	800
One boiler drilling machine	1,500
One crane in boiler shop	5,000
One hydraulic flanging machine	5,500
Crane for riveting machine	4,350
One accumulator	1,600
One hydraulic pressure-pump	1,000
One hydraulic plate-bending press	10,000
Freight and handling of the above, foundations, pipes, shafting, setting, etc.	12,000
Additions to cupolas and cranes in foundry	1,150
Total	55,255

The expenditures for the year, exclusive of those charged to vessels, are as follows:

Civil establishment	$4,541.66
Office expenses	1,317.98
Stores for general purposes	33,663.12
Handling stores	2,570.40
Care and repair of, and additions to shop tools	27,722.92
Running and firing yard engines and boilers	5,845.09
Care and repair of yard steam-launches, boilers, and engines	1,694.18
Launch machinery for general purposes	192.32
Superintendence of shops	8,163.00
Rolling-mill machinery	2,316.42
Transportation of stores	219.70
Breaking up old material	33.90
Holidays	1,495.50
Total	89,776.19

BOSTON NAVY-YARD.

This yard having been transferred to the Bureau of Equipment and Recruiting, but little work has been done there during the year.

Slight repairs were made to the machinery of the following vessels: *Wabash*, *Ossipee*, and *Rocket*.

The work done for other bureaus was briefly as follows:

Provisions and Clothing.—Repairing boiler and steam-heaters.

Yards and Docks.—Small castings.

Equipment and Recruiting.—Miscellaneous castings, such as forges and hammers, fittings for cranes and testing machine, grate-bars, fittings for galleys, etc.

The expenditures during the year, other than those for work done on naval vessels, are as follows:

Chief engineer's office, writers and messengers	$173.15
Store-house expenses, handling stores, etc	1,425.05
Holidays	179.14
Care and repair of shop machinery	5,129.97
Propeller shears at dry-dock	224.60
Value of tools, appliances, and machinery transferred to the Bureau of Equipment and Recruiting	13,325.82
Running and firing yard engine and boilers, with repairs to same	667.08
Repairs to engines and boilers of yard steam-launches	26.38
Total	21,151.19

LEAGUE ISLAND NAVY-YARD.

This yard not being at present used for general naval purposes, no work has been done on vessels, with the exception of such as is necessary for the preservation of the armored vessels laid up there, and preparing the monitor *Terror* for the passage to New York.

The expenditures for the year, other than those for work done on naval vessels, are as follows:

Civil establishment	$1,200.00
Office expenses, draughting, etc	63.41
Handling stores	335.70
Stores for general purposes	6.00
Transportation	3.92
Holidays	191.30
Care and preservation of machinery and tools	3,762.75
Total	5,563.08

WASHINGTON NAVY-YARD.

This yard having been transferred to the Bureau of Ordnance, the only work done, other than the care and preservation of stores and machinery, was slight repairs to the machinery of the following vessels: *Despatch*, *Rescue*, and *Swatara*, and the preservation of the machinery of the monitor *Saugus*.

The expenditures during the year, other than those for work done on naval vessels, are as follows:

Office expenses, writers, messengers, etc	$43.86
Superintendence of shops	582.00
Handling stores	937.86
Preservation of stores	192.98
Preservation, care, and repair of tools and shop plant	637.15
Handling machinery and tools	2,937.16
Care and repair of yard steam-launch machinery	45.11
Holidays	139.12
Work for Bureau of Steam Engineering	768.20
Total	6,283.44

PENSACOLA NAVY-YARD.

No work was done at this yard during the year on machinery of naval vessels.

The work of the Bureau has consisted principally in the care and preservation of the shop plant.

The expenditures were as follows:

Civil establishment, writer, office expenses	$950.67
Handling, care, and preservation of stores	786.55
Care and repair of shop machinery	1,170.28
Running, firing, and repairing yard engines and boilers	717.25
Care and repair of boilers and machinery of yard steam-launches	1,918.96
Holidays	51.19
Total	5,594.90

NAVAL STATION, NEW LONDON, CONN.

No work was done by the Bureau at this station except for the care and repair of steam-launches in use at the station.

No returns of expenditures have been received up to the present date.

NAVAL STATION, KEY WEST, FLA.

No work was done by the Bureau at this station except in the care and repair of the machinery in the shop and the shipment of stores.

No returns of expenditures have been received up to the present date.

NAVAL ACADEMY, ANNAPOLIS, MD.

During the last fiscal year the machinery of the following vessels was repaired by the Department of Steam Engineering: *Passaic*, *Phlox*, *Standish*, and *Wyoming*, and the necessary repairs to the thirteen steam-launches used for instruction of the naval cadets.

PERSONNEL OF THE ENGINEER CORPS.

I would again call attention to the rapidly decreasing number of engineers in the naval service. This number has already become too small to properly attend to the duties pertaining to the mechanical administration of the vessels of the old fleet, and will be found absurdly small when the new vessels now building are ready to be put in commission. It is a difficult matter to say just how many engineers we need, as no definite number or character of new vessels have yet been decided upon. Some idea of the relative number of officers of various kinds may, however, be formed by comparison with foreign navies. We naturally turn to the British navy for a comparison, not only on account of its importance, but also on account of the many similarities between the two English-speaking nations. Again, in making a comparison between officers performing various duties we naturally take as a basis of comparison the corps on which devolves the general executive duties of the service, the corps of officers of the line.

According to the last Navy Register we had 725 line officers of commissioned rank and 220 engineers, including the cadets who have since been commissioned, or 30 per cent. as many engineers as line officers. At the same time in the British Navy there were 1,517 line officers of commissioned rank and 698 engineers (English Navy List, January, 1888), or 46 per cent. as many engineers as line officers. Then, again, our engineer corps is being reduced to a limit of 170, while the engineer corps of the British navy is being increased to a limit of 750. When these limits have been reached we will have 23.5 per cent. as many engineers as line officers, while the English will have 49 per cent. They will then have, relatively to the officers of their executive corps, more than twice as many engineers as we, while at the present time they have half again as many. Moreover, the English have a large steam merchant marine from which engineers could be obtained to assist the regular force in time of war, while our source of similar supply is comparatively insignificant.

Besides all this, the engineer corps of the British navy is supplemented by an admirable force of "engine-room artificers", similar but superior to our force of "machinists". They get better artificers than we can; first, because the pay is relatively better, and secondly because English mechanics of a superior grade will enter the naval service as enlisted men, while similar mechanics in the United States command such advantageous positions and wages that they could not be induced, save in exceptional cases, to exchange the independence of a life on shore for the subordination of one on board ship as enlisted men under existing circumstances. As to the difference in pay, it can only be considered

by comparison, on account of the general differences in wages and in the purchasing power of money in the two countries. In England an "engine-room artificer" upon appointment gets a trifle more pay than a sub-lieutenant; while a chief engine-room artificer of the first class gets just one-half more pay than a sub-lieutenant, or as much as an assistant engineer after his first year of service. By comparing this with our own pay-table one reason for their getting a better force of artificers than ours will be apparent. As to numbers, there are at present in the British navy 1,163 chief and other engine-room artificers (Office of Naval Intelligence, General Information Series No. 7, p. 56), or about one and two-thirds for every engineer. In our own service there are about 145 machinists, of which 85 are serving on board of naval steamers in commission. There are 32 boiler makers serving on board ships in commission. The total number of men of the "engine-room artificer" class is then, allowing for varying numbers of recruits, etc., considerably less than 200, or less than one artificer to each engineer. We are, roughly speaking, only a little more than one-half as well off as the British navy in the matter of engineers, and one-third as well off in the matter of artificers. For the last twenty years there has been an almost steady decrease in the number of engineers without a corresponding increase in the number of skilled mechanics to assist them; while at the same time the complication of naval machinery has greatly increased.

For the purpose of showing how many engineers the new ships will require I present the following list where each new vessel is compared with a vessel of the British navy of the same engine power and with approximately the same arrangement of machinery compartments, two elements which determine the number of engineers required:

United States vessels.			British vessels.		
Name.	I. H. P.	Required number of engineers.	Name.	I. H. P.	Complement of engineers.
Petrel	1,300	1	Acorn	1,380	1
Dolphin	2,300	2	Diamond	2,140	2
Atlanta	3,500	3	Calypso	3,720	3
Boston	3,500	3	....do	3,720	3
Yorktown	3,300	3	Scout Porpoise	3,200 3,500	3 3
Concord	3,400	3	Porpoise	3,500	3
Bennington	3,400	3	....do	3,500	3
Vesuvius	3,500	2	Alacrity	3,180	2
Chicago	5,000	4	Phæton	5,500	4
2000-ton cruiser	7,500	5	Phæton Orlando	5,500 8,500	4 6
2000-ton cruiser	7,500	5	Phæton Orlando	5,500 8,500	4 6
2000-ton cruiser	7,500	5	Phæton Orlando	5,500 8,500	4 6
Charleston	7,500	5	Phæton Orlando	5,500 8,500	4 6
Newark	8,500	6	Orlando	8,500	6
Maine	9,000	6	....do	8,500	6
3000-ton cruiser	9,000	6	...do	8,500	6
3000-ton cruiser	9,000	6	...do	8,500	6
Texas*	8,600	9	...do	8,500	6
7500-ton cruiser	11,000	8	Impérieuse	10,000	8
Baltimore	10,750	8	...do	10,000	8
Philadelphia	10,750	8	...do	10,000	8
San Francisco	10,750	8	...do	10,000	8
5300-ton cruiser	12,000	8	....do	10,000	8

* Texas' force increased by reason of having eight fire rooms.

It will be observed that the average number of engineers necessary for these vessels is much greater than the average on an equal number of the vessels at present in commission; in fact, greater than on any one vessel.

No fewer engineers than these could be assigned to these vessels without detriment. Even these numbers will only be sufficient if they are to be supplemented by a proper force of skilled artificers to perform the minor duties. If such assistance can not be procured, then the only alternative is to increase the number of engineers on each vessel. The above list shows 117 engineers necessary for only the vessels named, to say nothing of those for service on minor vessels, on the double-turreted monitors now in course of completion, on the prospective coast-defense vessels, on rams and torpedo boats, on vessels of the Coast Survey, and on such other vessels as may be built. These will absorb nearly if not quite all the remainder of the present limit of 170; while experience has proven that the number of officers required for shore duty, in reserve, on leave of absence, sick, and on special duty is never less than the number at sea. In view of these facts I would recommend that the number of engineers be increased to not less than 300. Unless something is done in this direction before long the costly machinery of our new vessels can not receive the constant intelligent supervision while under way, and when overhauling and repairing while in port, which is absolutely necessary to keep it in proper condition and to prevent breakdowns.

The necessary increase in numbers should be made gradually, but an increase of twenty a year for the next five years would be none too rapid in view of the annual loss, principally by the resignation of young officers. But no engineer appointments should be made except from young men well grounded in theoretical mechanical engineering, as well as skilled in its practical application. Unless we can have the former course of instruction for cadet engineers re-established, or a course which will produce similar results, I would recommend that a certain specified number of appointments be annually given to the mechanical engineer graduates of such technical schools as Cornell, Stevens, Ann Arbor, and others which give a proper course of instruction. Such appointees should serve as cadet-engineers under probation for two years—one year at a navy-yard and one year at sea—before appointed as assistant engineers. In this way we could get the kind of material we need without waiting for re-establishment of the Naval Academy course.

In connection with the subject of the resignation of young officers above mentioned, I would call attention to one of the principal causes therefor—the "steerage". This is a part of the quarters on board ship which had its origin in the necessity for an apartment separate from the quarters of other officers, which would serve as a sort of nursery for the midshipmen of tender years who obtained their first naval training on board ship. Such a necessity no longer exists, for officers now first enter upon their ship-board duties at an age when they should be treated as men and not boys. Moreover, as promotion goes and under existing regulations, many of them remain "steerage officers" until middle age. Many ensigns, by being assigned to duty as "watch and division officers," happily escape the trials of the steerage after a few years, but the assistant engineers are obliged to occupy these quarters until promoted. There are some of these officers who have spent eight years' sea service in the steerage, and not likely to soon escape from it. Some of these steerage officers are from thirty to thirty-five years of age. That men of this age should be huddled together, like school-boys, in a

common dormitory is absurd, the only excuse for it being the traditions of the service. I think that if a canvass were made of all officers of all corps, a large majority of them would express themselves as in favor of the abolition of the steerage, or, rather, its annexation to the ward-room. Some slight remodeling of quarters would, of course, be necessary, but it would result in benefit to all concerned, and could not but add to the efficiency of the service by making the younger officers more contented with their lot and giving them a higher respect for themselves and their duties.

It is only by professional zeal, and sometimes with difficulty, that many engineers in the service are enabled to keep pace with the rapid advance of marine engineering practice. The routine duties of many of these officers occupy so much of their time that they have not sufficient leisure to keep up a proper course of professional study, even if indeed they had access to all the many sources of information. The information which is so difficult for each individual to cull out for himself could, however, be imparted to him in a short time by proper instruction. I would therefore advocate the establishment of a short course of higher instruction in engineering, which all the younger engineers should be obliged, and the older ones permitted, to attend periodically. The instruction should be given by specialists in various branches by means of well-illustrated lectures. Such instruction could be carried out at a navy-yard with but little expense, while the benefits to be derived would be altogether out of proportion to the small outlay.

I would again call attention to the injustice done to all engineer graduates of the Naval Academy, in the assignment of relative rank. Engineer students formerly entered the Academy upon a more advanced examination than was required for students of the line, and were graduated at a corresponding advanced date. Under existing law, however, they do not rank with the class of line officers with whom they were graduated, but after the class with which they entered the Academy, and which was subsequently graduated. The reason for ranking after this class is, that the entrance examination for cadet-midshipmen took place each year a short time before the examination for cadet-engineers, and the appointment of the cadets of the two corps thus differed by a few days. This, however, was enough to make the first man in the engineer class rank after the last man of the class of cadet-midshipmen which left the Academy two years after the former. Both the Navy Department and Congress have been, from time to time, appealed to to correct this injustice by making all graduates of the Naval Academy rank with each other according to relative merit at graduation, but none of these efforts have thus far proven successful. These officers are put to great inconvenience by being thus left behind other officers of the service with whom they first entered upon the regular duties of the Navy as commissioned officers. I would recommend that the Department invoke the assistance of Congress in this matter.

As the duties of the Engineer-in-Chief frequently call him away from Washington, leaving behind him a large amount of technical work, it is, in my opinion, desirable that he should be provided with an engineer assistant, who would in his absence become responsible for the work of the Bureau. The necessity for such an assistant has already been recognized in the case of the Bureau of Medicine and Surgery, the chief of which is allowed by law an assistant selected from the Medical Corps of the Navy. I would earnestly recommend that steps be taken to secure, in like manner, an assistant to the Chief of the Bureau of Steam Engineering.

ENLISTED MEN OF THE ENGINEER'S FORCE.

Now that the time is rapidly approaching when the boilers of all vessels in the Navy will be worked under forced draft, steps should be taken to educate the men of the fire-room force up to their new duties. A fireman accustomed only to natural draft becomes demoralized when set to work in a fire-room where the fires are urged to their utmost by powerful blowers, and where the evaporation is so rapid that but a momentary stoppage or derangement of the feed apparatus might lead to disastrous results. The education needed to enable the men to face this state of affairs is nothing more or less than experience with it. This never struck me so forcibly as when I lately went down New York Bay on board the *Swatara* to witness the working of the machinery. Although the vessel had been in commission for several months the men had had no experience with the forced draught except during a short trial trip. The fires were miserably worked; a state of affairs which must continue unless the men can have more opportunity to gain experience. As a means of remedying this, I would recommend two things:

First. That a small force of men trained in the handling of strongly forced fires and of quick steaming boilers be formed and quartered on board some vessel on the Atlantic coast where they could receive constant practice. These men should be water-tenders or men eligible to that rating. Then whenever a ship is fitted out this force in whole or in part could be temporarily transferred to her, forming a nucleus for the fire-room force. After running the trial trip and getting the other firemen somewhat accustomed to their duties, these men would be withdrawn, leaving a portion of their number on board to act as water-tenders, these men to be always drawn from this trained force. The vacancies thus occurring in the force would be filled by fresh men who would be put to work along with the skilled men until they in turn became proficient. To carry such a plan into effect one of the large tugs of the *Standish* class might be fitted with a boiler with forced draft appliances, and the men's quarters enlarged to accommodate the increased force. This vessel should then be kept under steam as much as possible and the men put on watch in sufficiently small numbers at a time to give them plenty of hard work to do to keep up the steam pressure. There should be no false attempt at economy in this matter by making the vessel serve as a freight-boat or transport, but she should be used only as an experience ship for firemen. A larger vessel with several boilers would of course be preferable to those named if one could be made available. We have training-ships for sailors, but we vainly imagine that the putting of a man down the fire-room hatch with a shovel in his hand makes him an expert fireman.

Second. I would recommend that every vessel fitted with forced draft appliances be made to cruise entirely under forced draft until the records of the work performed show that the men are sufficiently trained to get the proper amount of power out of the boilers. Thereafter the cruising could be done, if desired, with natural draft, except that a certain part of it should be done at maximum power. I do not mean to say that all the boilers should be used for forced draft, but that one or more boilers should be worked for all they are worth, and that no limit should be placed on the coal except the limit of the ability of the firemen to burn it. This would not be economical in the sense of actual cost, but we would have men trained to use the reserve boiler power when needed. Otherwise we might as well leave the blowers on shore and save the cost of freighting them around.

As to the men of the artificer's class, machinists, boiler-makers, etc., in addition to what I have said about them in connection with the engineer officers, I would here say that we can not expect to train them on board ship as we must needs train the firemen. We must get them ready made. Their trades are specialties which require a long apprenticeship to learn properly, and it is only in rare cases that a mechanic is found who has become fairly skilled by having "picked up" his trade. The practice of giving a man the rating of machinist as a reward for what he has done as a fireman is altogether wrong. Excellent firemen are often spoiled in this way to make worthless machinists. It is sometimes necessary to promote a fireman temporarily to fill a vacancy and keep up the complement; but such appointment should be of as short duration as possible, and the man should understand this when given the higher rating. A regular machinist should be supplied to fill the vacancy and the fireman returned to his station. No man should be permanently promoted to the artificer class unless he can convince a board of engineers, appointed for the purpose, by a thoroughly practical examination, that he can do the work of a trained mechanic.

REPAIRS ON FOREIGN STATIONS.

I would call attention to the fact that when vessels are kept on foreign stations for more than three years, or four years at most, their efficiency is greatly diminished on account of the unreliability of their machinery. Although vessels are often kept in commission for longer periods, presumably for the sake of economy, they cost no less in the long run, while at the same time they can not be depended upon as they should be. When machinery is properly overhauled and repaired it costs but a nominal sum for repairs during a three-years cruise, and the vessel is ready for sea whenever wanted. On the other hand, when repairs are neglected until breakdowns occur, and then only the most urgent repairs are made, the duties of the ship are frequently interrupted and the repair bills are piled up one after the other to an unnecessary extent, while the money spent for repairs goes into foreign pockets.

Among the vessels which I would recommend to be immediately brought home is the *Lancaster*. She has not been to a navy-yard for repairs since 1881, and is in a deplorable condition. The last report of her chief engineer states that the boilers are in such a condition as to be dangerous to the lives of the persons in attendance. These boilers will have to be taken out, while if they had been repaired three years ago they could have lasted for another cruise.

The *Quinnebaug* has not been home for repairs since 1879 and is in much the same condition as the *Lancaster*. She would have been useful for many years longer if proper precautions had been taken, but it is understood that her hull is in as bad a condition as the boilers, and it may not be found advisable to repair her.

The *Marion* came from China to Panama to change her crew and went back to her station, and although minor repairs have been made here and there, she is in a poor condition and was dubbed by the commander-in-chief of the Asiatic Squadron in a recent letter to me as one of the "tramps" of his fleet.

Among the other vessels which should soon be sent to navy-yards for thorough repairs to machinery I would note the following: *Brooklyn*, now on her way home from the Asiatic station; *Juniata*, on her way home from the Asiatic station; *Essex*, now on Asiatic station; *Galena*, now being temporarily repaired for a winter's cruise in the West Indies.

TUBULOUS, COIL, AND SECTIONAL BOILERS.

Boilers of these types have, as yet, been little used in naval vessels. The Belleville boilers have for several years been in successful use on board vessels of the French navy, but we have no records of its performance under forced draft conditions. The Thornycroft boiler is said to have proved highly successful in torpedo-boats, and boilers of the coil and sectional types have long been successfully used on steam-launches, yachts, etc. The important reduction in weight which would be effected by their use, if practicable, led the Bureau to suggest a competitive test to determine the best type, in accordance with the following advertisement and circular:

COIL-BOILERS FOR THE UNITED STATES NAVY.

NAVY DEPARTMENT,
Washington, D. C., August 2, 1888.

The Navy Department, having in view the possible decrease in weight of machinery in vessels of war by the use of tubulous, sectional, or coil boilers, has determined to adopt such boilers, if suitable can be found, for a portion of the steam-power of one or more of the vessels about to be built. To this end, manufacturers who wish to offer such boilers for use by the Department are hereby invited to furnish plans of the same, adapted to an armored coast-defense vessel, on or before September 15, 1888. Plans must be accompanied by certificates that boilers of the same make are or have been in successful use at sea or on shore. Plans showing the space in the vessel available for boilers, particulars of the duty required, and other information may be obtained upon application to the Bureau of Steam Engineering. The boiler which appears to the Department, after investigation, to be the best for the purpose, taking into account the evaporative efficiency, the dryness of the steam, the weight of the boiler, the weight of the water contained, the accessibility for repairs, the ease of making repairs, the simplicity and interchangeability of the parts, the space occupied, the ease of firing and of regulating the feed, the suitability for working in battery, the capability of long-continued steaming without cleaning, and the durability, will be adopted in the coast-defense vessel above mentioned, provided that the price, which must be stated when the plans are submitted, is satisfactory to the Navy Department. Such boilers as appear to possess merit will be tested by the Navy Department, if the manufacturers so desire, to determine which is the more suitable for the purpose. Manufacturers who wish their boilers to be tested must furnish a boiler of the type of one of those proposed for the vessel and prepare it for test either at their own works or at such place as may be arranged with the Department. The expense of the test of the accepted boiler will be borne by the Navy Department, and the cost of the fuel used in the test of the second best will also be borne by the Navy Department. All other tests must be at the expense of the parties offering boilers for competition.

WILLIAM C. WHITNEY,
Secretary of the Navy.

Circular embodying the conditions to be observed by persons submitting tubulous, sectional, or coil boilers for competitive test, in pursuance of the Navy Department advertisement of August 2, 1888.

On or before October 1, 1888, persons who wish to offer boilers in competition will furnish outline plans showing the boilers in place in the vessel for which they are intended—a blue-print of the boiler compartments of which vessel accompanies this circular.

The coil or sectional boilers must be designed to furnish continuously, under forced draft, with due economy, at least three-fourths of the steam necessary to work triple expansion engines of 4,800 I. H. P., at 160 pounds gauge pressure.

The boilers must be divided equally between the two boiler compartments. They will work in connection with the two cylindrical return-fire-tube marine boilers shown on the blue-print.

In the port boiler compartment is shown the general arrangement of boilers, blowers, etc., which the Department prefers, [two Ward boilers of size 0, No. 30, being taken as examples.] This arrangement of this or of any other type of boiler is not

imperative, however, and may be changed as desired, provided that the following conditions be observed, viz:

(A) The bulkheads of the boiler compartments, marked A A A, etc., can not be changed.

(B) The cylindrical return-tube marine boilers shown can not be placed further aft than their indicated position, but may be placed not more than 2 feet further forward.

(C) But if these boilers be moved forward, the coal-bunker bulkheads, marked B B, must be changed so as to retain the same coal-stowage capacity.

(D) The fire-room hatch, smoke-pipe, and passage-ways to engine-rooms can not be changed.

(E) Provision must be made for easily getting coal out of the forward and after coal-bunkers into each fire-room; any passages for this purpose between boilers being not less than 3 feet wide and 6½ feet high.

(F) There must be a fresh-water tank in each boiler compartment of sufficient capacity to hold water enough to fill the coil or tubulous boilers in that compartment to steaming level.

(G) There must be sufficient room around the coil or tubulous boilers to make such repairs as are likely to be needed, without removing any bulkheads, or, to any great extent, parts of the boilers themselves.

(H) There must be sufficient room in each boiler compartment for a main and an auxiliary feed-pump, each of sufficient capacity to feed all the boilers in the compartment.

There must be noted on the plans submitted the following information:

Area of grate-surface.

Area of heating-surface.

Weight of boilers and fittings.

Weight of uptakes and boiler-seatings.

Weight of water in boilers.

Center of gravity of boilers, etc., in steaming condition.

Proposed rate of combustion.

Proposed rate of evaporation per pound of coal from and at 212° F.

Total evaporation per hour from feed-water at 120° F. to steam of 160 pounds gauge pressure which will be guarantied.

Percentage of dryness of steam which will be guarantied.

There must also be a drawing of one boiler in sufficient detail to permit of its construction being understood.

Persons submitting plans must, in order to have them considered, submit also sealed proposals for furnishing the boilers at the New York navy-yard within six months after receipt of an order for the same, including all fittings, complete and ready to be erected on board ship, and to receive steam, water, and air connections. These bids must be accompanied by specifications stating just what is proposed to be furnished. These bids will be opened in the presence of competitors on October 1, 1888.

After an examination of the plans, those which appear feasible will be selected, and the persons offering them so notified. Such competitors as then wish to offer their boilers for test will be required to do so within three months from date of notice. The boilers offered for test must be of the type and approximately of the same size as those shown in the submitted plans and intended for the vessel. They must be fitted up complete for test at competitor's expense. For each boiler two tanks must be supplied, each of sufficient size to hold feed-water for at least 15 minutes' steaming—one for a measuring-tank and the other to feed from. Also, an accurate platform-scale, with a tank of about 50 gallons' capacity, for calorimetric tests. Also, a platform-scale for weighing coal. All testing instruments will be provided by the Navy Department.

An evaporate test, of not less than 24 hours' duration, using clean fresh water, will be made at the rate of combustion proposed to be used on board the vessel, all feed-water being measured, coal weighed, and steam tested for dryness. Steam will be kept at 160 pounds pressure in the boiler and will be blown off at the stop valve.

Boilers which give good results in evaporation will be further tried by being surrounded by walls (rough boards will be sufficient), representing the adjacent bulkheads on board ship, and, thus limited in room, the various joints of the boiler will be made and unmade, tubes or coils taken out and put in, etc., to prove that repairs can be properly made in the space available.

Satisfactory proof must be made that the boilers can be worked together in battery and in connection with ordinary marine boilers.

The boiler which, after the above specified tests, may be selected as the best for the purpose intended will, if considered necessary, be further subjected to a test to show whether or not it will work satisfactorily under the every-day conditions existing on board ship, with such feed-water as is obtainable after continued steaming, charged with grease, etc., from the engines.

Sufficient means must be provided for thoroughly cleaning the heating surfaces when using dirty coal.

The boilers made for use on board ship must be of domestic manufacture.

Either New River or George's Creek bituminous or anthracite coal will be used in the tests.

WILLIAM C. WHITNEY,
Secretary of the Navy.

NAVY DEPARTMENT,
Washington, D. C., August 16, 1888.

In response to the advertisement the following-named firms applied for and were furnished with copies of the circular and a blue print showing the space available in the coast defense vessel:

Name and address.	Name and address.
Heine Safety Boiler Company, Saint Louis, Mo.	National Water-Tube Boiler Company, New York, N. Y.
Herreshoff Manufacturing Company, Bristol, R. I.	James P. Witherow, Pittsburgh, Pa.
I. McK. Chase, Washington, D. C.	William H. Harrison, Braintree, Mass.
William P. Patton, Washington, D. C.	Abendroth & Root Manufacturing Company, New York, N. Y.
Miers Coryell, New York, N. Y.	Van Zile, MacCormack & Co., Albany, N. Y.
E. E. Roberts, New York, N. Y.	Electric Novelty Works, Baltimore, Md.
W. H. Bailey, New York, N. Y.	John Wilson, New York, N. Y.
Frank B. King, Washington, D. C.	Daniel W. Kellog, Auburn, N. Y.
John Wood, jr., Conshohocken, Pa.	P. F. Dundon, San Francisco, Cal.
John A. Svedberg, Washington, D. C.	Hohenstein Manufacturing Company, Newark, N. J.
Charles Ward, Charleston, W. Va.	
William Cowles, New York, N. Y.	
J. W. Walters & Co., New York, N. Y.	

Of these, the following submitted designs:

Hohenstein Manufacturing Company, Newark, N. J. Two batteries each of four sectional coil boilers, having a total grate surface of 208 square feet and a total heating surface of 14,000 square feet. Total weight of boilers, including water and fittings, 72.4 tons. Bid, $60,000 for the boilers fitted in ship.

John A. Svedberg, Washington, D. C. Four coil boilers; total grate surface, 200 square feet; total heating surface, 7,377 square feet. Total weight, including water and fittings, 50 tons. No bid.

Frank B. King, Washington, D. C. Four segmental water tubular boilers; total grate surface, 176 square feet; total heating surface, 8,824 square feet. Total weight, including water and fittings, 94.9 tons. Bid, $6,500 for each boiler.

Charles Ward, Charleston, W. Va. Four sectional boilers; total grate surface, 212 square feet; total heating surface, 8,036. Weight, including water and fittings, 60 tons. Bid, $20,960.

F. C. & A. E. Rowland, New Haven, Conn.: Ten Belleville boilers, arranged in two batteries, designed for 4,800 I. H. P.; total grate surface, 360 square feet; total heating surface, 10,010 square feet; total weight, including water and fittings, 141 tons. No bid.

William Cowles, New York: Four boilers; total grate surface, 212 square feet; total heating surface, 7,820 square feet; total weight, including water and fittings, 53.28 tons. Bid, $5,950 for each boiler.

William Cowles, New York: Four boilers; total grate surface, 212 square feet; total heating surface, 8,456 square feet; total weight, including water and fittings, 51.92 tons. Bid, $6,450 for each boiler.

Union Iron Works, San Francisco: Design of E. J. Moore for sectional boilers, but not in conformity with the requirements of the circular. No bid.

John Wilson, New York: Cut of coil boiler. No adaptation to the coast defense vessel. No bid.

Besides these, D. Davies, of Crumlin, England, submitted cuts of a boiler patented by him.

Owing to the pressure of other business, no decision has yet been reached as to which of these boilers will be tested.

EXPERIMENTAL WORK.

During the past year some experimental work has been done, principally in the way of testing material and inventions offered by manufacturers. I have selected some of the more important work, such as is of general interest, and present in an appendix synopses of the reports of the officers appointed to make the various tests. These tests were, briefly, as follows:

A test of a Belleville boiler on board the yacht *Shearwater*, which was kindly put at the disposal of the Bureau by the owner, J. M. Forbes, esq. This is a boiler which is but little known in this country, although in extensive use in France. The test was made to ascertain the evaporative power and the dryness of the steam. The boiler was not fitted with apparatus for forced draft, and its efficiency when so worked could not be ascertained, but it showed a very good result, as will be seen from the appended report, when worked under natural draft.

A new style of boiler made by the Herreshoff Manufacturing Company was tested, not only to ascertain its performance, but to find whether it could be easily operated by the ordinary firemen in whose hands it is frequently necessary to place our steam-launch machinery. The necessity of the employment of more than ordinary labor for its management was one of the drawbacks of the old Herreshoff boiler, and this having finally been recognized by the makers led to a new design. As the report shows, the boiler performed well and did not need the constant skillful attention which was necessary with the old form. The boiler was not arranged for high forced draft and was consequently tested with a moderately forced combustion only.

Another boiler tested was a small coil boiler using naphtha as a fuel, built by the Hohenstein Manufacturing Company, of Newark, N. J. Although this boiler was a very small one, the results are of interest as additional data on the evaporative powers of naphtha.

Upon the completion of the repairs to the *Swatara* at the Portsmouth (N. H.) navy-yard, a series of boiler tests was made to ascertain the evaporative efficiency under forced draft with and without circulating plates in the boilers to separate the upward and downward currents. These plates had been fitted in all the boilers, but were removed from one for the purpose of the tests. The results proved the value of the use of the circulating plates, as will be seen by reference to the appended report. Drawings are also appended, showing the arrangement of circulating plates in the boilers and the furnace fittings used with the closed ash-pit system of forced draft.

A very interesting test of a device for burning petroleum was made on a locomotive fitted up by the Petroleum Fuel and Motor Company, of Washington, D. C. The apparatus was very successful, and the evaporative results are, I believe, the best on record. Drawings of the appliances used for burning the petroleum are appended to the report.

A report is also appended of tests made on small oscillating engines, which the Bureau now uses for driving blowers and centrifugal pumps in steam-launches. The engine used is hardly more than a toy, being only 10 inches in height, and occupying about 5 by 7 inches floor space.

These engines were built under the direction of Chief Engineer G. F. Kutz, at the Mare Island navy-yard, and a pattern modified by the Bureau is now being put into several of the new launches. The tests are interesting as showing at what high speeds these very simple engines can be driven without difficulty. The highest speed noted in the appended report is only about 2,100 revolutions per minute, but a speed of 3,200 revolutions per minute has been reached with one of these little motors.

The Bureau, being desirous of finding whether either of the kinds of steam engine indicators used in the service had any advantage over the other, invited the manufacturers of the indicators to submit instruments for test. The method of test adopted by the Bureau was designed to show, principally, the regularity or otherwise of the indicator scales, and the retardation of the indicator pencil by the friction of the various parts of the instrument. As will be seen by the report of the tests and the accompanying diagrams, both of the instruments gave very good results, and the difference in their performance was very slight.

The Bureau is often called upon to test anti-friction metals which are presented for its consideration, and in each case tests these metals in competition with the best previously known, both metals being tested on the same machine so as to eliminate errors as far as possible. Many of the metals tested prove to be either worthless or no better than those in use. A metal known by the trade name of "Magnolia Metal" has, however, been lately tested, which has given such good results that a report of its test is here appended. The name of the metal against which it was tested, and which, although an excellent metal, came out second best, is omitted for obvious reasons.

Tests of the strength of aluminum bronze, specimens of which were furnished by the Cowles Electric Smelting and Aluminum Company, were made at the Watertown Arsenal under the supervision of an officer detailed by the Bureau. The appended report of results of the test shows the metal to be a valuable one where a non-oxidizable metal of great strength is required. The Bureau has had, however, no experience with it in large castings until quite recently, when two unsuccessful attempts were made to cast a propeller of this metal for the gun-boat *Petrel*, both castings having been condemned on account of blow-holes. It is probable, however, that the failures were due to a want of experience in making large castings of this metal, as it has heretofore been used in comparatively small castings only. It is to be hoped that the necessary experience in casting will soon be gained, as the metal is of undoubted value when good castings are obtained.

Another metal which has shown itself to be a valuable material is the bronze made by the De-oxidized Metal Company of Bridgeport, Conn., a report of the test of which is appended. The company claims, however, to be able to furnish a much stronger metal than that tested; the test specimens having been made of a composition specified by the Bureau, and not that preferred by the makers. The Bureau wished, however, to test a bronze having exactly the same composition as "navy bronze", except that the ingredients had been subjected to the de-oxidizing process of the above-mentioned company, so that the two bronzes could be directly compared.

Tests are about to be made to ascertain the casting qualities of this metal.

All the above-mentioned tests, except those of the *Swatara's* boilers and the small blower engines, were made at the expense of the parties submitting the articles to be tested; the Government being put to no ex-

pense except for traveling expenses of officers and transportation of instruments. The information gained is, however, not only of value to the Government but to the public at large. Moreover, the tests were made by engineers temporarily taken from other duties, and not by those specially detailed for such work. A great deal of experimental work should be done, especially in the way of high combustion and rapid evaporation, the proportions of triple and quadruple expansion engines, the proportions of high-speed screw propellers, etc., the cost of the results to be so obtained being infinitesimal compared with the value of the knowledge to be gained. I would recommend that an experimental board of engineers be appointed for such purpose, and that an appropriation be asked to defray the expenses of investigations looking to the increase of efficiency of naval machinery of all kinds.

ESTIMATES OF APPROPRIATIONS REQUIRED.

I would call attention to the fact that every cent of the amount that I have estimated for the coming year under the appropriation "steam machinery" will be needed, and I am not entirely satisfied that I should not have asked for more. The appropriations have been decreased every year lately without a corresponding decrease in the necessity for expenditures.

The appropriations under the head of "steam machinery" for the past few years have been as follows:

Date.	Amount.	Date.	Amount.
Year ending June 30—		Year ending June 30—	
1883	$1,200,000	1887	$763,000
1884	1,000,000	1888	675,000
1885	920,000	1889	605,000
1886	950,000		

From this it will be seen that in seven years the appropriation has been decreased just about one-half. During that period a number of vessels have been sold; but the amount of machinery to be repaired, preserved, and renewed has not decreased in anything like the ratio of reduction of the appropriations. In fact the machinery of a number of vessels which were built between the years 1872 and 1878, upon which very little has been expended, are now just beginning to need extensive repairs. Each year repairs which should have been made have laid over until the next year's appropriation became available. Work thus accumulates from year to year, machinery being temporarily patched up which should be put in good condition. As an illustration of this I may cite the case of the *Essex*, whose old boilers were patched up before her present cruise, when new boilers were really needed, simply because of a scarcity of funds. The consequence is that this vessel has been a "lame duck" nearly all the present cruise on the Asiatic station, and would probably fail if needed suddenly on any service where full speed would be required.

There are two things which, I have no doubt, to some extent influence the Congressional committees in annually reducing the appropriations: First, there is generally a balance left at the end of the year, which, they argue, was unnecessarily appropriated; and secondly, if we get along on a certain amount one year, we should, by the exercise of greater economy, be able to get along with less the next year. As to the bal.

ance at the end of the year, we must either have a balance or a deficiency. While we have stations scattered all over the face of the earth where expenditures are constantly being made, it is impossible to regulate the expenditures with such nicety as to make both ends meet exactly at the end of the year, and it is better to be on the safe side and avoid a deficiency. It will be noticed that the balance on hand at the end of the last fiscal year is larger than usual. This is due to the fact that certain materials which were needed were not purchased until close to the end of the year, when we knew about how much money could be used without causing a deficiency. A delay of a few days in placing some of the orders made it impossible to pay for the material out of last year's appropriation, and it will, in consequence, have to be paid out of this year's. As to greater economy, I can not see how, under existing circumstances, the expenditures can be reduced. An examination of the records and correspondence of the Bureau, showing how we are obliged to exercise the greatest care in order to make both ends meet, will convince any one of this fact.

There are more vessels now undergoing necessary repairs than at any one time for several years back, while several vessels now on foreign stations will need thorough overhauling with new boilers during the present year. It is almost certain that a number of vessels will have to be laid up towards the end of the year waiting for the next year's appropriation to become available.

The appropriations which I have asked for to purchase new tools for navy-yards are strongly recommended; also the appropriation for experimental purposes, the necessity for which I have elsewhere noted.

My estimate of $2,100,000 for construction of new machinery under the head of "increase of the Navy", was based on the following calculations:

The vessels now building and authorized are as follows:

Name.	When authorized.	When to be completed.	Contract price.	Limit to cost.	Reference to appropriations.
Charleston	Mar. 3, 1885	Nov. 20, 1888	$1,017,500	$1,100,000	ACF.
Yorktown	do	May 20, 1888	455,000	520,000	ACF.
Petrel	do	Dec. 22, 1887	247,000	275,000	ACF.
Baltimore	Aug. 3, 1886	Nov. 20, 1888	1,325,000	1,500,000	BCF.
Maine	do			2,500,000	BCF.
Texas	do			2,500,000	BCF.
Vesuvius	do	May 20, 1888	350,000	350,000	BCF.
Torpedo-boat	do	June 1, 1889	82,750	100,000	BCF.
Double-turreted monitors (for completion).	do			3,178,046	BCF
Newark	Mar. 3, 1887	Oct. 27, 1889	1,248,000	1,300,000	DF.
Philadelphia	do	do	1,350,000	1,500,000	DF.
San Francisco	do	Oct. 26, 1889	1,428,000	1,500,000	DF.
Bennington	do	May 15, 1889	490,000	550,000	DF.
Concord	do	do	490,000	550,000	DF.
Floating batteries, etc	do			2,000,000	EF.
Cruiser of 7,500 tons	Sept. 7, 1888			3,500,000	F.
Cruiser of 5,300 tons	do			1,800,000	F.
Cruiser of 3,000 tons	do			1,100,000	F.
Do	do			1,100,000	F.
Cruiser of 2,000 tons	do			700,000	F.
Do	do			700,000	F.
Do	do			700,000	F.
Practice steamer	do			260,000	G.
			8,483,250	20,283,000	

The letters in the last column refer to the following appropriations:

The appropriations thus far made for these vessels, exclusive of appropriations for armor of vessels building in navy-yards, vessels for coast

defense, etc., are as follows, the reference letters showing for which of the above vessels the various amounts are available:

A. Mar. 3, 1885. "Increase of the Navy"			$1,895,000
B. Aug. 3, 1886. "Increase of the Navy; vessels and monitors"			2,500,000
C. Mar. 3, 1887. "Increase of the Navy; monitors and vessels authorized by the acts of March 3, 1885 and August 3, 1886"			2,420,000
D. Mar. 3, 1887. "Increase of the Navy; gun-boats and cruisers"			1,500,000
E. Mar. 3, 1887. "Increase of the Navy; vessels for coast and harbor defense"			1,000,000
F. Sept. 7, 1888. "Increase of the Navy; construction and steam machinery"			3,500,000
G. Sept. 7, 1888. "Increase of the Navy; steel practice vessel"			260,000
Total			13,075,000
From this should be deducted E and G, as they are for specific purposes, and not available for vessels generally			1,260,000
			11,815,000
Also deduct the following amounts, which are included in B:			
For experimenting with torpedoes, etc		$75,000	
For improving navy-yard plant, etc		150,000	
			225,000
			11,590,000
To the contract prices of vessels now building, or		8,483,250	
Must be added for expenditures outside of contract, for preliminary expenses, inspection, trial, equipment and outfit, etc., not less than 8 per cent		678,660	
There must also be added the premiums to be paid for increased speed and horse-power, which may be, if expectations are realized, as follows:			
Charleston	$50,000		
Yorktown	50,000		
Petrel	10,000		
Baltimore	175,000		
Newark	50,000		
Philadelphia	100,000		
San Francisco	100,000		
Bennington	5,000		
Concord	5,000		
		545,000	
			9,706,910
Leaving available			1,883,090
Judging from the estimates for vessels now building, it may be said that, roughly speaking, this amount will be expended, two-thirds for hulls and one-third for machinery; thus leaving for machinery, in round numbers			627,000
From this deduct the amounts that may be expended on the *Maine*, *Texas*, and *Monadnock*, for machinery, during the current year, as follows:			
Maine and Texas		$100,000	
Monadnock		80,000	
		180,000	
			180,000
Leaving a possible balance at the end of the current year			447,000
The cost of machinery of vessels not yet under contract may be estimated, in round numbers, as follows:			
Maine and Texas			1,000,000
Monadnock			220,000
Six tugs (submitted)			150,000
Cruiser of 7,500 tons			700,000
Cruiser of 5,300 tons			600,000
Two cruisers of 3,000 tons			900,000
Three cruisers of 2,000 tons			1,050,000
			4,620,000

This will not all be expended in one year, and, supposing no work to be done on the vessels authorized by the act of September 7, 1888, except in the way of preparation, during the present fiscal year, there would be required during 1889-'90 the following portions of the sums above estimated:

Maine and Texas, one-half	$500,000
Monadnock, two-thirds	140,000
Six tugs, all	150,000
Cruiser of 7,500 tons, two-fifths	280,000
Cruiser of 5,300 tons, one-half	300,000
Two cruisers of 3,000 tons, one-half	450,000
Three cruisers of 2,000 tons, two-thirds	700,000
Probable expenditure in 1889-'90	2,520,000
From which deducting the possible balance at the end of the present fiscal year ($447,000), leaves to be appropriated for machinery of new vessels already authorized, and for the six tugs submitted, in addition to machinery for such additional vessels as may be authorized	2,093,000
Or, in round numbers	2,100,000

I have the honor to submit herewith the estimates for appropriations for this Bureau for the fiscal year ending June 30, 1890.

Very respectfully,

GEO. W. MELVILLE,
Chief of Bureau.

Hon. W. C. WHITNEY,
Secretary of the Navy.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1890 by the Bureau of Steam Engineering, Navy Department.

Detailed objects of expenditure, and explanations.		Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1889.
STEAM MACHINERY.			
For completion, repairs, and preservation of machinery and boilers of naval vessels, tugs, launches, and torpedo-boats, including cost of new boilers and auxiliary machinery; labor in navy-yards and on foreign stations; purchase, handling, and preservation of materials and stores; purchase, fitting, repairs, and preservation of machinery and tools in navy-yards and stations; running yard engines; for incidental expenses, such as foreign postage, telegrams, advertising, freight, photographing, draughting, books, plans, models, stationery, instruments, and apparatus (act September 7, 1888)		$800,000.00	$805,000.00
CONTINGENT.			
For contingencies, drawing materials, and instruments for the draughting-room (same act)		1,000.00	1,000.00
CIVIL ESTABLISHMENT.			
Navy-yard, Portsmouth, N. H.:			
Clerk to department, per annum (act September 7, 1888)	$1,200		
Messenger, per annum (same act)	600		
		1,800.00	
Navy-yard, Brooklyn, N. Y.:			
Clerk to department, per annum (act September 7, 1888)	1,400		
One writer, per annum (same act)	1,000		
One messenger, per annum (same act)	600		
		3,000.00	
Navy-yard, League Island, Pa.:			
Clerk to department, per annum (submitted)	1,200		
		1,200.00	

Estimates of appropriations required for the service of the fiscal year, etc.—Continued.

Detailed objects of expenditure, and explanations.		Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1889.
CIVIL ESTABLISHMENT.			
Navy-yard, Norfolk, Va.:			
Clerk to department, per annum (act September 7, 1888)	$1,300		
One messenger, per annum (same act)	600		
One writer, per annum (submitted)	1,000		
		$2,900.00	
Navy-yard, Pensacola, Fla.:			
One writer, per annum (act September 7, 1888)	1,000		
		1,000.00	
Navy-yard, Mare Island, Cal.:			
Clerk to department, per annum (act September 7, 1888)	1,400		
One writer, per annum (same act)	1,000		
One messenger, per annum (same act)	600		
		3,000.00	
		12,900.00	$17,000.00
SALARIES.			
Chief clerk (act July 11, 1888)	$1,800		
One clerk of class two (same act)	1,400		
One clerk of class one (same act)	1,200		
One assistant messenger (same act)	720		
Two laborers (same act)	1,320		
		6,440.00	
DRAUGHTING-ROOM.			
One chief draughtsman (act July 11, 1888)	2,250		
One chief draughtsman, increase (submitted)	250		
One draughtsman (act July 11, 1888)	1,400		
One draughtsman (same act)	1,000		
One draughtsman, increase (submitted)	200		
		5,100.00	
		11,540.00	11,090.00
INCREASE OF THE NAVY—STEAM MACHINERY.			
On account of the steam machinery of new ships heretofore or hereafter authorized by Congress (submitted)		2,100,000.00	
IMPROVEMENT OF THE PLANT AT THE NAVY-YARD, NEW YORK.			
Extra tools required to put the yard in condition for building and repairing modern marine machinery with economy and dispatch, including traveling crane in foundry and in new boiler-shop, and a 600-ton proving and testing machine (submitted)		155,000.00	
IMPROVEMENT OF THE PLANT AT THE NAVY YARD, NORFOLK, VA.			
Extra tools required to put the yard in condition for building and repairing modern marine machinery with economy and dispatch, including improvements in handling machinery, and in the boiler-making plant (submitted)		60,000.00	
IMPROVEMENT OF THE PLANT AT THE NAVY-YARD, MARE ISLAND, CAL.			
Extra tools required to put the yard in condition for building and repairing modern marine machinery with economy and dispatch, including improvements in boiler-making plant, improved machine tools, etc. (submitted)		55,000.00	
EXPERIMENTAL PURPOSES.			
For investigations with a view to increasing the efficiency of naval machinery in the matter of economy, lightness, and increased power, by systematic experiments with various kinds of improved steam generators, engines, forced-draft, propellers, materials of construction, and such other experimental work in connection with naval machinery as may be found expedient, including purchase of materials (submitted)		25,000.00	
		295,000.00	

APPENDIX.

REPORT OF A BOARD OF U. S. NAVAL ENGINEERS ON THE BELLEVILLE BOILER OF THE STEAM-YACHT SHEARWATER, AT WOOD'S HOLL, MASS., NOVEMBER, 1887.

In obedience to the order of the Navy Department of the 28th of October ultimo, and in accordance with the instructions of the Bureau of Steam Engineering of the 4th instant, we have made a careful test of the Belleville boiler of the steam-yacht *Shearwater*, and submit the following report:

DESCRIPTION OF THE VESSEL.

The *Shearwater* is a steel yacht, built according to the design of Mr. Edward Burgess for Mr. J. M. Forbes, of Milton, Mass. The engine was designed and both hull and engine built by the Atlantic Works, of East Boston, Mass., Mr. James T. Boyd, engineer and superintendent. The boiler, with its attachments complete, was built at the Belleville Works, St. Denis, France, and imported for this vessel.

The principal particulars of the hull are as follows: Length over all, 129 feet; length on load water-line, 108 feet; beam, molded, 17 feet 11 inches; depth from top of keel, 10 feet; crown of deck, 5 inches; draught of water, 6 feet 6 inches; displacement, 115 tons; midship section, 68 square feet; overhang at stern, 21 feet; stem, vertical above water-line; bar keel of rolled iron, 5¾ by 1½ inches; stern-post and rudder-post forged in one piece, with section, 5¾ by 2½ inches; stem, rolled iron, 5¾ by 1½ inches; the frames are spaced 21 inches between centers, and are of angle iron 2½ by 2½ by $\frac{5}{16}$ inches.

Floors are in one piece, 13 inches deep by ¼ inch thick under the engine; reverse angle irons, 2 by 2 by ¼ inches; keelson on top of floors, 7½ by ⅜ inch plates, with 3 by 2½ by $\frac{5}{16}$ inch angles. The plating is run in fair lines, in and out strakes, and is of mild steel; garboard and shear strakes, $\frac{5}{16}$ inch; remainder, No. 3 B W. G. thick, for half of the length amidships, and reduced forward and aft to No. 5 B. W. G.

Stringers on beams are of steel, No. 3 B. W. G., 16 inches wide, and connected to sheer strakes with 5 by 2½ inch channel-iron. At break of deck on beams, stringers are 16 inches wide. At break in continuation of main deck, stringer is an angle iron, 6 by 3 by ⅜ inches, riveted to clips on frames and attached to bulkheads. Deck-beams are spaced on every frame and are angle irons 4 by 3 by $\frac{5}{16}$ inches, with bracket ends 10 inches deep. Those forward and aft of half length are of reduced size. The fore-and-aft plates on each side of hatches are of steel, 6 by ¼ inches, riveted to deck beams. There are two bilge stringers on each side, 3½ by 2½ by $\frac{5}{16}$ inches. In addition to breast-hook of deck stringer there is one at load line of ¼-inch steel plate, fastened to reverse bars by 2 by 2 by ¼ inch angle iron, extending over three frames. There is a collision bulkhead forward, and a water-tight bulkhead aft, at forward end of stern-tube, of $\frac{3}{16}$-inch steel. The coal-bunkers are of $\frac{3}{16}$-inch steel. The stem, rudder and stern-posts, and keel are double-riveted, all other riveting being single. The rudder has a wrought-iron frame plated with $\frac{3}{16}$-inch steel. The bottom is cemented with Portland cement carried well up into the turn of the bilge.

There are two light masts, 9½ inches diameter, 55 feet high, with fore-and-aft rig.

ENGINE.

The engine, designed to develop 220 horse-power, is of the vertical, inverted, direct-acting, compound type, with cylinders of 12½ and 25 inches diameter, and 20 inches stroke of piston; working pressure 120 pounds per square inch by gauge in high-pressure cylinder. The condenser is of the Wheeler double-tube type, the circulating water entering the outer tubes and returning in inner tubes of the lower half, then passing through inner tubes and returning by outer tubes of the upper half of the nest. The condensing surface is 440 square feet. The condenser is located

on the port side, opposite the cylinders, with tubes horizontal and fore and aft. It is elevated sufficiently above the engine bed-plate to conveniently place the air and circulating pumps directly underneath it. The pumps are horizontal and direct-acting, the steam-cylinder forward, circulating-pump in the middle, and air-pump aft, the three piston-rods being continuous. The diameter of the steam-cylinder is 6 inches, that of air and circulating pumps 8 inches, the stroke being 12 inches. The circulating water is delivered to a chamber between the two tube-sheets at forward end of condenser. This chamber is divided into equal parts by a partition midway between its top and bottom. The forward part of condenser is dished to form a channel-way from lower to upper half of nest of tubes, for the passage of circulating water. The nozzles for the inlet and outlet of circulating water are on the lower and upper sides of the rectangular box at end of condenser. The tubes are screwed into the tube-sheets at the forward end. The caps by which the outer tubes are closed at the after end are of sufficient size to form supports from shell of condenser for the lower row of tubes and thence upward for all the other rows. The inner tubes are open at the after ends and supported concentrically within the outer tubes by small pins screwed into their sides near the ends. The exhaust steam is delivered to the outside of tubes through an opening in the top of condenser and at the middle of its length, being first passed through a kind of strainer, or "grease-collector," as it is called, which is bolted directly to the nozzle. This grease-collector is a rectangular box containing porous metallic strainers. The condensed steam and air are conveyed by a copper pipe from the middle and bottom of condenser to the air-pump, and thence delivered to a tank above the pump. The feed-water is drawn from this tank and delivered to the boiler by the independent feed-pump on starboard side of engine-room. An injector is connected to main feed-pipe for feeding the boiler whenever required. A second pump is connected to the bilge, sea, and hot well, and to the fire-service pipes, but can not be used to feed the boiler.

The piston-rods of the main engine are each 2¼ inches in diameter; cross-heads, 3 by 6 inches; slides, 6¼ by 12 inches; connecting-rods, 50 inches between centers; crank-pin journals, 5¼ by 5¼ inches; crank and line-shafting, 5¾ inches in diameter at journals. The forward crank-shaft journal is 8 inches, the middle one, 16 inches, and the after one, 10¾ inches long. The greatest pressure on crank-pins, with steam of 120 pounds pressure in high-pressure cylinder, is 409 pounds per square inch.

The steam-pipe is 3½ inches and the exhaust-pipe, 7 inches in diameter. The steam-ports in high-pressure cylinder are 10 by 1¼ inches, the opening being 1 inch; those in low-pressure cylinder, 19 by 1¾ inches, with $1\frac{1}{16}$-inch opening. The exhaust-port in high-pressure cylinder is 10 by 3 inches, and in low-pressure cylinder, 19 by 3¼ inches. Travel of valve, 3¾ inches. The throttle is a plain slide valve with three ports, 1 by 4 inches each. Both cylinders are fitted with Meyer cut-off valves, with separate eccentrics. The main valve-gear is of the Stephenson type. The cut-off blocks are adjusted by a screw-stem, easily worked from engine-room.

There is a small vertical reversing-engine on the forward and starboard side of bed-plate which exhausts into the condenser.

The propeller is a true screw, of cast-iron, 6 feet in diameter and a pitch of 8 feet, the blades being cut away at the ends to give them somewhat the form of a Griffith's blade. The casting is in one piece and the hub only large enough for the requisite strength.

BOILER.

The boiler consists of a system of tubes of equal length joined together by junction-boxes of malleable steel, so as to form a series of flat coils, each of which is connected to the feed-water box or collector *C* (Plate 1) at the lower end of the coil, and to the steam-drum *D*, at its upper end. The steam-drum, into which the feed-water is also delivered, is connected with the feed-water collector and a vertical cylindrical vessel, called a sediment-collector, by two outside pipes, *E* and *E'*, the one on the starboard end leading direct to the feed-water collector.

This arrangement permits of a continuous circulation of water and steam through the tubes to the drum and of the water from the drum to the feed-water collector.

Each coil consists of sixteen lap-welded, wrought-iron tubes, $3\frac{3}{16}$ inches in outside diameter, and 61¼ inches long between junction-pieces at the front and back, the tubes being arranged in two vertical rows side by side. The back junction-boxes are simple U connections, with the centers of the openings for receiving the tubes in the same horizontal plane half-way between the levels of two adjacent front junction-boxes, and have on their upper and lower sides proper projections for supporting them, one above the other, in the required positions. The front and lowest junction-boxes, *b*, *b*, resting directly on the feed-water collector, have each four openings for the reception of tubes, one opening in the lower row being blanked off; the other front junction-boxes, *a*, *a*, form simple horizontal U connections like those at the back. The tubes in each vertical row are parallel, those in the right-hand row rising gradually from the front to the back, and those in the left-hand row, from the back

to the front. The lower front junction-boxes have two chambers, the upper one forming a U connection; the lower one, which receives the lower end of the last tube, has in its lower side a conical opening, into which fits a conical nipple on the feed-water box or collector *C*, the joint being made with a thin conical metal washer, a single bolt and nut securing the joint and the junction-box to a projection on the front of the feed-water collector. The upper tube of each set is connected by means of an elbow and a short vertical tube having a flange-joint to the steam-drum.

Each set of sixteen tubes is called a "tubular element," eight of these forming the boiler. The whole of each element is heating surface.

On the front of each front junction-box and opposite the tubes there are circular sight-holes, $2\frac{3}{4}$ inches in diameter, for inspection and cleaning. These holes are closed by means of wrought-iron plugs, each held in place by a single anchor or T-head bolt and nut, the joint being made with linen asbestos cardboard.

The junction-boxes are $\frac{1}{4}$ inch and the tubes $\frac{3}{16}$ inch thick, except those in the lower row in direct contact with the fire, which are $\frac{4}{16}$ inch thick.

Each tubular element, *A*, *A*, is complete in itself and independent, being connected with the other elements only through the feed-water collector below and the steam-drum above. In case of any accident to a tube or tubes of an element, the latter can be readily and quickly disconnected and removed by means of a railway provided for the purpose, the connection holes blanked, and the rest of the boiler used without inconvenience.

The tubes are screwed into the back junction-boxes with ordinary gas-threads and further secured by jam-nuts screwed up hard against the faces of the boxes; at the front ends they butt against nipples, threaded similarly to the tubes, and are held in place by screw-couplings, shouldered against the faces of the boxes and secured by jam-nuts on their backs. By this arrangement, after an element has been removed from the boiler and is accessible in all its parts, any two tubes, connecting in the same back junction-box, may be removed and renewed without disturbing any of the others, a valuable consideration and great convenience in case of repairs.

The eight tubular elements occupy a space 73 by 78 by 50 inches high. The furnace, grate, and ash-pan are directly under the tubes, the bars being $21\frac{1}{2}$ inches below the lower tubes at the front and 28 inches at the back end. The ash-pan is 16 and 13 inches below the grate at the front and back, respectively. The furnace is rectangular, the grate-surface being 82 inches wide by 60 inches long, giving 34.17 square feet of surface.

The feed-water collector *C*, which extends across the entire front of boiler, just above the furnace doors, and on which the lower front junction-boxes rest, and to which they are connected as before described, is of iron, forged in rectangular section, 5 by 5 inches outside, five-eighths of an inch in thickness, and is connected to the top of the sediment-conector *G* and to pipe *E'* by elbows, screwed into the front near the ends, and secured by jam-nuts, similar to those on joints of tubular elements.

Just below the feed-water collector and close to it, there is a small steam-pipe, *S*, connected to the stop-valve near the steam-drum, which supplies steam to four cylindrical nozzles, spaced equally across the furnace, for the purpose of blowing steam above the fires. This device is termed "the mixer of gases." Its use with bituminous fires is advantageous, probably from the fact that it tends to keep the outside surfaces of tubes clean, thus securing better draft; but, with anthracite fires, its use tends to, and if continued sufficiently long, it is said, will extinguish them.

The tubular elements, fire-box, and ash-pit are inclosed by a rectangular casing (at the sides and back) of boiler-iron, with a double arched covering forming the uptake. The casing in front is formed by two large doors, *O*, extending from the feed-water collector to the top and between the side castings. The furnace-doors or fronts are of wrought iron with double shell and extend from the feed water collector down to the level of the front bearing-bar. There are two doors, each 33 inches wide by 13 inches high. The ash-pit doors, *s'*, are hung horizontally on two pivots at half their height in such a manner that they may be used as dampers or wholly removed, as may be desired. The boiler casing, from the top down to the level of the upper side of front junction-boxes, is 88 inches wide by 78 inches deep outside, and consists of a double shell stiffened by angle-irons, the inclosed space, 4 inches wide, being filled with ashes packed hard. Below the above level, down to the plane of the grate-bars, the two sides consist of single thicknesses of plate-iron, stiffened by angle-irons and lined with fire-bricks; this lining, for 13 inches down, being $11\frac{1}{4}$ inches, and, for the rest of the way, 10 inches thick. At the back, the double shell casing extends down 11 inches further than at the sides; from its end, the single casing, lined with fire-bricks from $13\frac{5}{8}$ to 11 inches in thickness, extends to the box mentioned below. On the top and front of this back lining there is a single course of fire-bricks, put in place after the tubular elements are put in, and adjusted to support the back junction-boxes at the required height. The sides and back of the ash-pit are inclosed by rectangular boxes open at the bottom, those at the sides being 10, and those at the back, 12 inches wide. These boxes are made of boiler-iron and their tops, which are

in the plane of the grate-bars, form shelves on which the brick-work rests. The casing from the beginning of the fire-brick lining down to the bottom of the ash-pit is larger than that above, being 102½ inches wide by 81 inches deep outside.

The French grate-bars supplied with the boilers are of wrought iron, $\frac{4}{10}$ inch thick and 4 inches deep, and are described as being alternately flat and undulated, with spaces between them of the form of elongated triangles. The advantage is claimed for them of maintaining a sufficiently low temperature to prevent the adherence of clinker, the bars being, therefore, easily kept clean. These bars were not used during the trial, ordinary cast-iron ones being substituted, these having larger air spaces and the experience of the engineer on board having demonstrated also that these were easiest kept clean.

B B are fusible plugs. *P P* are movable partitions of cast-iron placed between the tubes. *Q*, sheet-iron obstruction, placed over elements.

BOILER ATTACHMENTS.

These attachments, generally described as the Belleville patents, are as follows: "The collector-purifier of steam and feed-water," which we call the steam-drum; the "sediment receiving-chamber," or, sediment-collector; the automatic feed-water regulator; the "general steam separator," with its automatic purge; the "steam-pressure regulator," or reducing valve; and the special feed-pump.

The internal arrangement of the steam-drum, as applied on board the *Shearwater*, is entirely different from that generally described.

The general steam separator with its automatic purge has not been applied to the *Shearwater* and is not shown.

The steam-drum *D D*, used on the boiler tested, was made complete in France, and its interior is, therefore, entirely inaccessible for measurement. From what could be seen and felt through the hand-holes, the drawings on plate 1 have been made, which clearly show the arrangement, although not accurate in internal dimensions. From this arrangement it will be observed that the centrifugal theory is ignored.

The drum is 77 inches long and 19 inches in external diameter, with a double chain-riveted lap seam and flanged heads, secured by single riveted seams. Its interior is divided into three nearly equal compartments, *Z*, *T*, and *X*, by diaphragm plates, *x*, *y*, and *s*, extending its whole length, bent and riveted together along a line near the axis. A shelf, *e*, of channel-iron near the top of the compartment *Z*, is secured to and extends the whole length of the drum. The feed-water is delivered at *g* in the middle of the length of the drum, and above the shelf *e*. The diaphragm-plate *y* is curved, as shown, extends beyond the junction seam towards the shelf *e*, and to it is secured a second curved plate, *v*, by means of light *Z* pieces, the two curved plates together forming guides for the steam coming from *t t*. Compartments *Z* and *T* communicate through the triangular openings *U* and *U′* cut from plate *x*, as shown. Compartments *X* and *T* communicate through the long, slender dry-pipe *r*, which is rectangular in section and extends about two-thirds the length of the drum. A copper drain-pipe, *F*, with a branch to each end of the drum, connects the lowest part of compartment *X* with the sediment-collector. Steam is taken from the top of *X* and at the middle of its length, through a narrow port, about 1½ by 6 inches, without internal pipe, and led to the stop-valve on the right and safety-valve on the left side, as shown. From the bottom of *Z*, pipes *E* and *E′*, leading to the sediment-chamber and feed-water collector, connect through the heads.

The manner in which the drum operates is supposed to be as follows: Steam is delivered into *Z* through *t*, *t*, and directed by the guide-plates towards the shelf *e*, where it thoroughly mixes with the feed-water and heats it sufficiently to precipitate the lime salts. The steam escapes through the triangular openings *U* and *U′*, into *T*, and thence through the dry-pipe and *X* into the main steam-pipe. The water and sediment fall to the bottom of *Z* and through the pipe *E* into the sediment-chamber, and through the pipe *E′* into the feed-water collector direct.

The sediment-chamber *G* is a cylindrical, wrought-iron drum, 35 inches long and 10¼ inches in external diameter, placed vertically on the port side and on front of boiler, the pipe *E* being connected to its upper head. On its side, near the upper end, is the connection to the feed-water collector, and at about one-third its height from the bottom is a cock through which the sediment is blown.

The automatic feed-regulator is arranged to maintain the water level at a constant height and is placed in the feed-pipe *M M* (Plate 1) near the end of the steam-drum, and between it and the graduated check-valve and cock *J*.

Plate 2 shows the automatic feed-regulator in detail. The stand-pipe *K* (see Plate 2), connected at the top with the steam and at the bottom with the water space, has on its side the glass water-gauge and within it the float *X*, which, through the interior rod and lever *l* and outside lever *E*, actuates the conical regulating valve *V*. The tension of spring *Z* on the counterpoise is steady, and the weights *Q* so propor-

tioned that each one will cause a variation of one inch in the water level. The valve *V* rises with the water level, thus reducing the feed-water supply. Valve *R* is simply a second check-valve in the feed-pipe *y* (*M* on Plate 1) above the hand check-valve *J*. The feed-water is delivered to drum through *W*.

The theory of the regulator is correct; but, like the automatic purge of the general steam separator, there seems to be an unnecessary complication for the service to be performed. We think that in time this would seriously interfere with its successful working, although during the trial its working was perfectly satisfactory.

THE STEAM-PRESSURE REGULATOR.

In order to have a sufficiently high temperature in the steam-drum to precipitate all the calcareous salts held in solution in the feed-water, the pressure must be maintained there above 120 pounds per square inch by gauge. To permit this and the use of a lower pressure at the engine, the special reducing valve, shown at fig. 2, plate 2, was devised by Mr. Belleville. The chamber *A* contains a cylinder in which works a piston-valve. Attached to the valve is a plunger, *C*, which passes through a stuffing-box above and into a guide still higher up. Near the top of the plunger is the cross-head *b*, to which are attached four spiral springs, *F*, *F*, *F*, *F*. These springs extend down, outside of the chamber and below it, to a second cross-head, *b′*, which may be raised or lowered by a screw-spindle and hand-wheel, thus diminishing or increasing the tension of the springs. The arrows show the direction of the steam; *A B*, in the elevation, being the axis of steam-pipe. The piston-valve closes the ports until tension is put on the springs, when it opens them and allows steam to enter *A*. The pressure tending to push the valve up acts on an area equal to the cross-section of the plunger and is balanced by the tension of the springs. By varying this tension the steam-pressure at the engine may be varied at will.

THE SPECIAL BELLEVILLE FEED-PUMP.

In a boiler of such small water-capacity as the Belleville, where the feed supply must be continuous and variable in quantity, special provision is required. For this purpose, the automatic feed is designed, but its operation reacts on the pump, affecting its speed, and if the flow of water were sufficiently reduced, would be liable to stop it. To obviate this difficulty, a special pump has been designed, but its principle of action is not novel in this country, it being almost identical with that of the original Worthington pump. In this pump, the pressure on the water piston is relieved just before the completion of the stroke at each end, thus allowing the full force on the steam piston to move the valve during the rest of the stroke. The details by which this is effected are, however, different. In the Belleville pump, there is a curved lever at each end of the water cylinder, a projection on the lever forming the relief-valve.

The coal bunkers of the Shearwater have a capacity of 14 tons, are situated on each side of the boiler and fire-room, and extend from the forward athwartship boiler-bulkhead to 6 feet 6 inches abaft the boiler front, a door on each side giving access to them.

The engine, boiler, coal bunkers, and fire-room occupy the entire width of the vessel and a length of 22 feet 4 inches; 7 feet 2 inches of which is boiler space, 8 feet, fire-room space, and 7 feet 2 inches, engine space.

There are two tanks forward, of a combined capacity of about 1,700 gallons, from which the waste of fresh water in engine and boiler is made up.

The smoke-pipe is 31 inches in diameter and 20 feet high above uptake, or 29 feet above grate-bars.

WEIGHTS.

Most of the weights were furnished by the Atlantic Works, East Boston, the rest being computed:

	Pounds.
Engine	33,000
Boiler, exclusive of bricks and ash filling	31,870
Boiler brick-work (computed)	7,000
Boiler-casing filling (computed)	1,800
Water-tanks	2,083
Steel hull	115,700
*Water in boiler (computed by Atlantic Works)	3,000

* The weight of water put in boiler to working level during trial was 2,100 pounds by measurement.

	Pounds.
Water in tanks (computed by Atlantic Works)	13,000
Water in condenser and pipes (computed by Atlantic Works)	2,000
Coal in bunkers (computed)	31,300
Total weight	240,753

This weight is exclusive of wood-work and outfits. The total weight, as estimated by displacement, is 113 tons of 2,240 pounds.

MANNER OF MAKING THE TRIAL.

For the purpose of determining the economic evaporation of the boiler, all coal was carefully weighed, in bags containing 100 pounds of coal each, on a Fairbanks platform-scale. The bags were tallied as they were taken from the coal-shed, a check-tally kept on the yacht, and the empty bags afterwards counted to verify these tallies. All water fed to the boiler was drawn by the feed-pump from two, leveled, wooden tanks through a hose, the connection between the pump and hot-well having been broken. These tanks were so arranged that one could be pumped down to the limit, (a block about 2 inches high secured to the bottom of each tank,) while the other was filling. A careful man was stationed at the tank stop-valves, with special instructions to close tight the valve on the tank which had been drawn from, before opening the one on the full tank. Owing to the scarcity of fresh water, the water from the hot-well was pumped into the measuring tanks through a hose, only enough fresh water being drawn from the tanks of the Fish Commission to completely fill one measuring tank before the other was emptied. There were no leaks in the tanks, pipes, valves, and connections to boilers. The tanks were slightly irregular and, therefore, their capacities were determined by weighing them on an accurate platform-scale. The weight of water contained in No. 1 tank at 66 degrees was 1,901 pounds and in No. 2, 1,929 pounds at 70 degrees. A high grade thermometer was placed in the stop-valve chamber on the steam-drum and another, in throttle-valve chamber at the engine. Thermometers were also placed in the fire-room, on deck in the shade, and in the measuring tanks. It had been the intention to place a pyrometer in the uptake at the base of smoke-pipe, but the instrument did not arrive in time. The approximate temperature of the products of combustion at that place was found by placing small pieces of tin, lead, and zinc on bits of fire-brick supported on the upper rows of tubes at the middle and front of boiler. The reading of the barometer was also taken. At the end of every four hours during the trial, the ash-pans were hauled and the dry ashes weighed.

All preparations having been made, fires were started in the usual manner at 12.30 p.m. on Saturday, November 26, 1887, the ship being secured to wharf at the Fish Commission station at Wood's Holl, Mass. Steam formed at 12.50. The engines were then started and kept running until it was found that everything was in working order. At 2 p.m., the fires being in average condition, the water-level was marked on the glass gauge, the feed-pump started on a full tank, No. 2, the coal account begun, and the trial considered as having commenced, all data thereafter being observed and entered hourly in the log. The trial continued twenty-four hours, frequent calorimetric tests being made.

The calorimeter and connections were arranged as follows: A clean alcohol barrel, of about 50 gallons capacity, was placed on a very sensitive and previously adjusted new Fairbanks scale, a drain-valve fitted to the bottom, and a thermometer, made by Huddleston, Boston, and graduated to one-half of a degree Fahrenheit, secured in the top head. A hose brought the coldest fresh water in the vicinity from one of the Fish Commission tanks to the barrel. Steam was taken from the center of the main steam pipe, just in front of the throttle, and led to the barrel by a three-fourths inch iron pipe, well covered and about 20 feet long, to which was coupled a short piece of steam hose. A brass diaphragm with a one eighth inch hole was placed in the coupling to wire-draw the steam. The hose was punctured with several one-fourth inch holes near its free end, to reduce the shocks when steam was flowing into the water in the barrel.

The tests were made as follows: The barrel having been drained and its weight with attachments noted, was filled to within 5 or 6 inches of the top, the weight again taken, and the temperature of the contained water noted. Steam was then blown through the pipe and hose until they were cleared of all condensed steam and thoroughly heated, when the hose was put in the barrel and the steam-pressure at throttle noted. When the temperature of the water in the barrel had been raised to about 111°, the water during this time being continually agitated, the hose was quickly removed, and the temperature of the water, weight of barrel and contents, and steam-pressure at throttle noted.

From the data thus obtained the quality of the steam (that of "saturated" steam being unity) was computed by the following formula:

$$Q=\frac{1}{l}\left[\frac{W}{w}(h'-h)-(T-h')\right]$$

Where W = weight of cold water in barrel.
w = weight of water added by passing steam into water.
T = total heat in water due to the temperature of steam at the observed pressure.
l = latent heat of steam at the observed pressure.
h' = total heat of water of final temperature in barrel.
h = total heat of water of initial temperature in barrel.

The percentage of moisture in the steam is, therefore, 100 (1 — Q).

The observed data and computed results of the trial are given in the following tables, the second one giving the data of calorimeter tests.

The evaporation given in the first table is the apparent vaporization from the tank measurements and should be corrected for the percentage of moisture, as found by the calorimeter measurements, by adding to it.

TABLE I.

Duration of trial, in hours	24	Average temperature of fire-room	99.160
Total weight of coal consumed during trial ... pounds..	10,500	Average height of barometer, in inches of mercury	30.330
Total weight of ashes from coal during the trial ... pounds..	808	Temperature in uptake, about	650
Total weight of combustible and volatilizable matter in coal ... pounds..	9,692	Total water evaporated during the trial ... pounds..	85,570
Coal consumed per hour ... pounds..	437.500	Total water evaporated per hour, pounds	3,565.4
Coal consumed per hour, per square foot of grate ... pounds..	12.804	Water evaporated, per pound of coal, pounds	8.15
Average steam pressure at boiler, per gauge	111.340	Water evaporated per pound of combustible ... pounds..	8.83
Average steam pressure at engine, per gauge	88.400	Water evaporated per square foot of grate per hour ... pounds..	104.34
Average temperature of steam at boiler.	353.420	Equivalent evaporation per pound of combustible, from the temperature of of 212°, and at atmospheric pressure.	10.42
Average temperature of steam at engine	335.540		
Average temperature of feed-water	79.400		
Average temperature of atmosphere	51.080	Grate surface, square feet	34.17

NOTE.—All temperatures are in degrees Fahrenheit, and all pressures in pounds per square inch.

TABLE II.

No. of test.	Time at beginning of test when steam was turned in.	Time at end of test when steam was shut off.	Steam pressure by gauge at beginning of test.	Steam pressure by gauge at end of test.	Weights.					Temperatures.				Percentages.	
					Barrel and all attachments.	Barrel, etc., and water.	Water (W).	Barrel, water, and condensed steam.	Condensed steam (w).	Air at calorimeter.	Initial temperature of water in barrel (t).	Final temperature of water in barrel (t').	t'-t.	Of steam, 100 Q.	Of water, 100 (1-Q).
	P. M.	P. M.													
1	3.31	3.48	90	90	74.	417.0	343.0	438.5	21.5	52	45.0	111.0	66.0	94.2	5.8
2	4.31	4.50	91	90	73.75	400.75	327.0	421.5	20.75	52	44.5	110.5	66.0	92.68	7.32
3	6.01	6.23	85	80	73.5	411.75	338.25	432.75	21.0	52	44.5	110.25	65.75	95.03	4.97
4	8.19	8.31	85	85	73.25	414.0	340.75	435.25	21.25	52	44.0	110.5	66.5	95.845	4.155
	A. M.	A. M.													
5	1.25	1.40	94	95	73	400.5	327.5	422.0	21.5	50	44.5	112.5	68.0	92.32	7.68
6	5.48	6.12	95	90	73.25	417.5	344.25	440.0	22.5	49	44.5	112.5	68.0	92.87	7.13
7	7.19	7.43	90	90	73.25	416.75	343.5	439.5	22.75	49	44.5	112.75	68.25	91.38	8.62
8	9.30	9.56	85	88	73.25	417.0	343.75	438.5	21.5	52	45.5	111.25	65.75	94.15	5.85
9	10.56	11.22	90	87.5	73.	420.0	347.0	442.0	22.0	54	46.5	112.75	66.25	93.56	6.44
	P. M.	P. M.													
10	12.07	12.29	90	89	73.	420.0	347.0	441.75	21.75	58	46.5	112.75	66.25	94.88	5.12

From Table II it is seen that the average amount of moisture in the steam is 6.31 per cent.

As shown by the above tables, the evaporative capacity of the boiler is not particularly high, and the steam furnished as dry as is usually found in practice where no

special provision has been made for drying or superheating. The rate of combustion was only 12.8 pounds per square foot of grate, and it is not certain that, with a high rate of combustion with forced draft, the steam would be as dry.

The coal used was Cumberland, of good quality, mined during the present season at George's Creek mine, and was the average run, not selected. The percentage of ash was less than 8 per cent., although a small amount of fine coal fell through the bars and was weighed with and counted as ashes. The fires were not forced, even by the steam-jet over the fire doors, and the smoke-pipe was not sufficiently high to produce a strong draft. The temperature in the uptake was found to be as high as the melting point of zinc, (the sharp edges of which had been slightly touched,) the tin having completely disappeared and the lead melted down and partially oxidized.

STRENGTH AND SAFETY OF THE BOILER.

In all tubulous boilers, of which the Belleville is one type, dependence is placed upon the rapid production and use of the steam. Their interior capacity is small, and hence, in case of explosion, the quantity of explosive being smaller, the result must be less disastrous than it would be in the case of shell boilers. The tubes and connections of this boiler are of such small dimensions and excessive strength, compared with the strains imposed on them, that the boiler may be termed non-explosive, as far as these parts are concerned. In the *Shearwater's* boiler, the part subjected to the greatest strain in proportion to its strength is the steam-drum, the strength of which may be taken, therefore, as the measure of the strength of the boiler. The reported United States Government test of a piece taken from this drum showed a tensile strength of 54,000 pounds per square inch, with a reduction of area of 12 per cent. The thickness of the drum is given as one-half inch, (its actual thickness is 15 millimeters, nearly five-eighths inch,) and its outside diameter is 19 inches.

Taking the usual formula, $P = \frac{2ts}{D}$, allowing 70 per cent. for the strength of double-riveted seams, and using 6 as the factor of safety, we get for the maximum, safe-working pressure,

$$P = \frac{2 \times \frac{1}{2} \times .7 \times 54{,}000}{6 \times 18} = 350,$$

or two and one-third times the maximum pressure ever carried.

Reported tests by the French builders showed a tensile strength of 59,000 pounds per square inch, with a reduction of area of 19.2 per cent. Using this in the above formula, the greatest safe pressure allowable becomes 381.5 pounds per square inch.

It will be noticed that there is a difference in the reduction of area of the materials as found by the American and French tests. The reduction of area would indicate, in a measure, the ductility of the material and the facility with which it can be worked, but can have only a limited bearing on the strength of the finished structure. A more important consideration, bearing on the safety of a boiler, is the limit of the elasticity of the material; for, after having been once strained beyond this limit, its ability to resist subsequent strains is diminished. Besides considering the *Shearwater's* steam-drum as a simple hollow cylinder, it must be remembered that the diaphragm plates lend considerable additional strength by their stiffening influence, a fact which must be apparent.

In view of the above considerations, there is no hesitation in expressing the opinion that the Belleville boiler of the *Shearwater* is perfectly safe for a pressure of 300 pounds per square inch.

PERFORMANCE OF THE VESSEL.

It is doubtful if any complete and carefully-measured data of the performance have ever been taken, as none were obtainable by the board. The machinery is well proportioned, and is capable of developing the 220 horse-power for which it was designed, provided that sufficient steam were supplied, but it is not certain that so much power has ever been realized. It is said that, under favorable circumstances on one occasion, a run of 48 nautical miles was made in four hours; the revolutions per minute were 170, but neither the coal consumption nor indicated horse-power were given. In ordinary steaming the speed, as given by the officers on board, is about 10 knots, occasionally, but rarely, reaching 11 knots, with a coal consumption of about 450 pounds per hour. No log is kept.

During the boiler test, several sets of diagrams were taken from the engines—one set, with 143 revolutions per minute, giving an indicated horse-power of 132.60; and another, with 137 revolutions, 127.65.

CONCLUSION.

It is to be regretted that there were no means of increasing the rate of combustion and production of steam by a powerful forced draft. Under the conditions of the trial, the evaporation and rate of combustion were not greater than in boilers in common use in the naval service. The boiler steamed freely, was under easy control, and furnished comparatively dry steam. Its weight seems excessive for the quantity of steam furnished, but this is due largely to the heavy casing and brick-work, which would be proportionally less for a number of boilers placed together. The advantage of accessibility of its parts for repairs may be, perhaps, offset by extra liability to derangement on account of the large number of joints required in the fire-surface. During the trial, however, the joints were all perfectly tight, the boiler being new.

This report would be incomplete without an acknowledgment of the assistance rendered and facilities furnished by the officers of the U. S. Fish Commission at Wood's Holl, and particularly of the liberality of Mr. Forbes, who not only placed the yacht and her crew at the disposal of the Government for the trial, but also supplied some necessary instruments.

Very respectfully,

A. S. GREENE,
Chief Engineer, U. S. N., Senior Member.
J. F. BINGHAM,
Passed Assistant Engineer, U. S. N.
F. C. BIEG,
Assistant Engineer, U. S. N.

Engineer-in-Chief GEO. W. MELVILLE, U. S. N.,
Chief of Bureau of Steam Engineering, Navy Department, Washington, D. C.

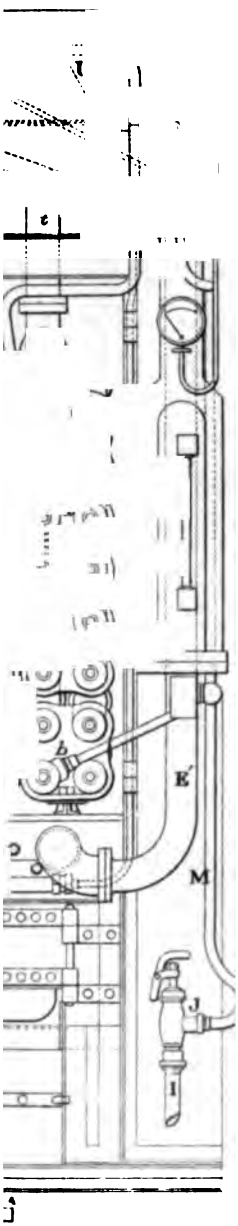
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Photo-Lith. by A. HOEN &

REPORT OF A BOARD OF NAVAL ENGINEERS ON THE TESTS OF A HERRESHOFF BOILER, NEW TYPE, FITTED ON THE LAUNCH "JERSEY LILY", AND OF A HERRESHOFF BOILER, OLD TYPE, FITTED ON THE LAUNCH "OUR MARY", AT BRISTOL, R. I., APRIL 19, 20, AND 24, 1888.

WASHINGTON, D. C., *May* 17, 1888.

SIR: In obedience to the Department's order of the 14th instant, and under instructions from the Bureau of Steam Engineering, letter No. 508, we proceeded to Bristol, R. I., to the works of the Herreshoff Manufacturing Company, for the purpose of testing a new design of boiler made by that company.

Our instructions contemplated two special tests of the boiler under maximum conditions of forced combustion, with measurements of the evaporation and quality of steam furnished, and an indication of the power of the engines. The Messrs. Herreshoff did not anticipate tests of this character, and, therefore, no provision had been made for making them. No indicator gear was fitted to the engines and, owing to the light hull of the boat, the rough water which prevailed, and the limited time before delivery to the owner, they were led to decline a full-power trial at the wharf. Facilities were, however, furnished for evaporative and calorimetric tests under natural draft, and for a full-power trial in free route, with the combustion forced by means of the steam-jet in the smoke-pipe.

DESCRIPTION OF THE BOILER.

The new design differs materially from any heretofore adopted by the Herreshoff Company. The boiler consists of a number of vertical elements, each composed of horizontal tubes (five tubes in the boiler tried) of equal lengths, with right and left hand threads, and connected by return bends. Two adjacent elements are connected at the back and lower ends, by short vertical tubes, to a Y-piece, which has a short connection to a mud-drum, situated below the grate-bars. At the upper ends, the same elements are similarly connected to a steam-drum situated just in front of the boiler casing. There are twenty-two of these tubular elements, the lower tubes being about thirteen inches above the grate-bars. At each side of the grate, there is a similar element having a longer connection to the steam-drum and a shorter one to the feed-water pipe near the mud-drum. These side elements and the vertical connecting pipes to the mud-drum serve like water-legs to protect the boiler-casing from the intense heat of the fire. Above the boiler proper and entirely within the casing, there are three horizontal elements forming a practically continuous pipe, the tubes of which are connected to each other as in the vertical elements. These elements serve as a feed-water heater and also protect the top of the casing by reducing the temperature of the gases of combustion.

In front and at the upper part of the boiler is the centrifugal separator, from the top of which the main steam-pipe leads to the engine, and at about the middle of which the steam-drum is connected. The upper element of the feed-water heater receives the main feed-pipe, the lower element being connected to the bottom of the separator. From each side of the separator and near its bottom, a tube leads the heated feed-water underneath the side element to the mud-drum. The ash-pan, mud-drum, grate-bars, furnace, and all tubes are inclosed in a rectangular double-shell casing of No. 16 iron, the 1½-inch space between the shells being filled with mineral wool. The ash-pan is of No. 12 iron. The extreme dimensions of the casing are 3 feet 7½ inches by 3 feet 7½ inches, and 3 feet 10½ inches high. At the top, the casing slopes from the smoke-pipe to each side, making the height 6 inches less than in the middle. The steam-drum and separator project in front of the casing 14 inches. All tubes of the boiler and feed-water heater are of iron, 1 inch in inside diameter, and were separately tested, before they were put in the boiler, to a pressure of 1,000 pounds per square inch. The U-connections are of malleable cast-iron, carefully selected.

The accompanying drawings, which are on a scale of ¼, clearly show the design of the boiler.

Before starting fires, water is pumped into the boiler until it shows in the glass on the separator, at the level indicated in the drawing. As steam is formed, water is

fed to the upper part of and through the feed-water heater and thence to the bottom of the separator, from which the side tubes, before described, lead it, together with any water that may have come from the steam-drum, to the mud-drum. From the latter it circulates upwards through the tubes of the boiler proper. The design looks towards a complete, or nearly complete, conversion of the water into steam before it reaches the steam-drum.

The object of the present design is to produce a boiler which will not require, as did the original Herreshoff coil boiler, the close attention to the feed-water supply, or, at least, not more than is required in any quick-steaming boiler of the ordinary shell types.

The first boiler built on this design, and the one tested by us, is placed on board of a large launch, the *Jersey Lily*, which is intended for special excursions and arranged to carry the largest possible number of passengers. The hull is very light, finished inside and out in mahogany, with iron strengthening frames. There is a light canopy and a small pilot-house forward.

The engines are of the vertical, inverted, direct acting, triple-expansion type, exceedingly light, but of the best materials and highest class of workmanship. All cylinders are fitted with piston-valves, worked by eccentrics on a counter-shaft which is geared to the main shaft. There is only one eccentric and rod for each valve. The reversing is effected by means of spiral feathers, pinion and rack, the latter being concentric and revolving with the shaft. There is an outside keel condenser. The air and feed pumps are vertical, and are worked by beams and links from the cross-heads of the low and high-pressure piston-rods, respectively.

The following are the principal dimensions of the hull:

	Ft.	In.
Length over all	65	0
Length on water-line	63	5
Beam	10	8
Draught, amidship (light)		33
Draught at stem and stern (light)		0

Weight of hull, boiler, and machinery complete, without coal or water, and two men on board, 7.81 tons.

The principal dimensions of the engine are as follows:

	Inches.
Diameter of high-pressure cylinder	4
Diameter of intermediate-pressure cylinder	6¼
Diameter of low-pressure cylinder	10
Stroke of pistons	8
Diameter of high-pressure valve	2
Stroke of high-pressure valve	1¼
Diameter of intermediate-pressure valve	2¼
Stroke of intermediate-pressure valve	1¼
Diameter of low-pressure valve	3¼
Stroke of low-pressure valve	1¼
Steam-ports, high-pressure and intermediate-pressure cylinders	⅝
Steam-ports, low-pressure cylinder	½
Cut-off, in all three cylinders, from commencement	⅝

The condenser is a copper tube 39 feet 6 inches long, $\frac{1}{16}$ thick, and tapering nearly uniformly from 3½ to 1 inches.

The air-pump is single-acting. 3½ inches in diameter and has a stroke of 3¼ inches. There are two feed-pumps, each ⅞ inch in diameter and a stroke of 3¼ inches.

NOTE.—Two feed-pumps are required with the coil boiler, one to draw from the hot-well and the other from the s parator. With the new boiler, only one pump is required, as the water from the separator falls by gravity to the lower part of the boiler.

Weight of engines, complete, including crank-shaft, 831 pounds.

No particulars of the propeller were furnished.

The principal dimensions of the boiler are as follows:

Grate surface, 3 by 3 feet	square feet	9.0
Heating surface above grates, in boiler proper	do	134.52
Heating surface above grates, in feed-water heater	do	70.76
Heating surface, total	do	205.28
Ratio of grate to heating surface		1 to 22.81
Weight of empty boiler, including attachments	pounds	2,945
Weight of water in boiler to steaming level	do	105
Total weight of boiler and water	do	3,050

Under the Bureau's modified instructions (Letter No. 520) the tests mentioned on page 1 of this report were made. In addition, we made a short evaporative and cal-

orimetric test of a rectangular coil boiler. This boiler was of the same outside dimensions of casing as the other and was in the launch *Our Mary*, a duplicate of the *Jersey Lily*.

In each of the three tests, the boiler was first pumped up to the steaming level and then a wood fire started, steam being raised in from five to ten minutes. A fire was then started with 30 pounds of white pine, a quantity considered just sufficient to ignite the coal, which was thereafter so supplied as to keep the fire in a uniform condition. The height of the water in the gauge was marked and the trial considered as having commenced.

In the first trial, firing was stopped at the end of six hours, the coal then in the furnace burning out in one hour and twenty minutes.

The following table gives the results of the first trial:

Evaporative test of the boiler of the Jersey Lily, at Bristol, R. I., April 19, 1888.

[All weights are in pounds and all temperatures in degrees Fahrenheit.]

Totals.

Duration of trial, in hours	6.0
Coal consumed	497.0
Refuse from coal	126.0
Combustible consumed	371.0
Water evaporated, by tank measurement	3,165.2

Averages.

Temperature of feed-water	62.0
Temperature of uptake	427.5
Temperature of atmosphere	50.0
Temperature of steam, by thermometer	340.0
Pressure of steam, by gauge	120.4

Ratios.

Coal per square foot of grate, per hour	9.33
Combustible per square foot of grate, per hour	6.89
Water evaporated from 62 degrees, per pound of coal	6.37
Water evaporated from 62 degrees, per pound of combustible	8.53
Water evaporated, equivalent to, from and at 212 degrees	10.23

The coal was "red ash" anthracite, egg size, and of good quality.

During the trial, six calorimetric tests were made, the quality of the steam being computed by the formula.

$$Q=\frac{1}{l}\left(\frac{W}{w}(h'-h)-(T-h')\right)$$

Q=quality of steam, dry saturated steam being unity.
W=weight of water originally in calorimeter.
w=weight of water added to W by condensed steam.
T=total heat of water, due to observed pressure of steam.
l=latent heat of steam at observed pressure.
h=total heat of water of initial temperature, in calorimeter.
h'=total heat of water of final temperature, in calorimeter.

The observed data and computed results are given in the following table:

Calorimeter tests of Herreshoff boiler (new type) in launch Jersey Lily, at Bristol, R. I., April 19, 1888.

No. of test.	Time. At beginning of test.	Time. At end.	Steam pressure by gauge. At beginning.	Steam pressure by gauge. At end.	Weight of empty barrel. b.	W + b.	W.	W + w.	w.	Temperatures. Final. t'.	Temperatures. Initial. t.
1	A. M. 11.13	A. M. 11.35	115	120	39.9	196	156.1	205.1	9.1	111.3	48.4
2	A. M. 11.57	P. M. 12.17	125	116	39.3	196	156.7	205.4	9.4	111.0	47.7
3	P. M. 12.47	P. M. 1.09	122.5	115	39.5	196	156.5	206.2	10.2	111.5	46.3
4	1.32	1.58	122	122	39.3	196	156.7	205.4	9.4	111.2	46.1
5	2.07	2.40	120	120	39.6	196	156.4	205.5	9.5	110.7	45.9
6	3.11	3.33	123	121	39.9	196	156.1	205.25	9.25	110.6	46.5

Calorimeter tests of Herreshoff boiler (new type) in launch Jersey Lily, etc.—**Continued.**

No. of test.	Units of heat.						Q.
	h'.	*h*.	*h'-h*.	*l*.	*T*.	*T-h'*.	
1	79.4009	16.4015	62.9994	867.7412	320.4620	241.0611	.966
2	79.0998	15.7010	63.3988	866.4778	322.2531	243.1533	.939
3	79.6016	14.3007	65.3009	867.2365	321.1773	241.5762	.992
4	79.3005	14.1009	65.1996	865.8555	323.1361	243.8356	.974
5	78.7088	13.9010	64.8078	866.6859	321.9580	243.1692	.952
6	78.6085	14.5006	64.1979	865.8555	323.1361	244.4376	.969
						Average Q	.965

From the average value of Q it will be seen that the moisture was 1.0—0.965=0.035, or 3½ per cent.

To determine the equivalent evaporation, had all the heat absorbed by the water in the boiler been utilized in producing dry steam, we have the following data and the computations therefrom:

Average steam pressure, absolute (p)	135.1
Temperature corresponding to this pressure (t)	350.077
Units of heat in 1 pound of steam at pressure p, from 32°	1188.7135
Units of heat in 1 pound of water at pressure p, from 32°	322.1943
Total weight of feed-water of a temperature of 62°	3165.19
Units of heat in 1 pound of water of a temperature of 62°	30.0075

1188.7135—30.0075=1158.706=units of heat required to convert 1 pound of water at 62° to steam at pressure p.

322.1943—30.0075=292.1868=units of heat required to raise 1 pound of water from 62° to temperature t.

But only 0.965 of the water fed to the boiler was converted into steam, the remainder, 0.035, passing over as moisture of a temperature t.

Therefore, 3165.19×0.965=3054.408=pounds of water converted into steam. This required an expenditure of 3054.408×1158.706=3539160.876 units of heat.

To raise the remaining water from 62° to the temperature t required (3165.19—3054.408)×292.1868=32369.038 units of heat.

Therefore, there was absorbed by the 3165.19 pounds of water fed into the boiler a number of units of heat equal to 3539160.876+32369.038=3571529.914, and hence, $\frac{3571529.914}{371 \times 1158.706}$=8.31=equivalent evaporation per pound of combustible from 62° and under an absolute pressure of 135.1 pounds.

And (8.31×1158.706)÷965.7=9.97=equivalent evaporation from and at 212°.

During the trial there was at no time any evidence of priming, no difficulty was experienced in manipulating the boiler, and the engines were not slowed for any purpose.

FREE-ROUTE TRIAL OF THE LAUNCH "JERSEY LILY", APRIL 20, 1888.

Steam was raised in nine minutes. Eight minutes after starting the coal fire the engines were started and the launch put under way. At 10.11 a. m., when the steam-gauge showed 145 pounds pressure, the jet was put on and continued in use until the end of firing, except when the safety-valve, which had been set at 200 pounds, lifted. The water from the condenser was measured into the hot well, as was also that supplied to the auxiliary pump, the waste of steam by the jet and safety-valve being supplied from a barrel of fresh water carried on board.

Five hundred and thirty-five pounds of coal, of the same quality and size as that used in the trial at the wharf, were put on board and burned, the last coal being fired at 12.25 p. m. From this time the fire continued to burn for 56 minutes more. The amount of refuse remaining, when the furnace was cleaned, was much smaller than that in the previous trial, owing to the use of forced draft.

The engine data, which were taken every seven and one-half minutes during two and one-half hours of the greatest performance, are averaged below:

Steam-pressure, by guage, in pounds per square inch	195
Vacuum, in inches	24.5
Revolutions per minute	471.7
Lowest number of revolutions per minute	426
Highest number of revolutions per minute	488

Total weights, in pounds:

Coal consumed	535
Dry refuse from coal (no allowance for coal and ashes carried out of smoke-pipe)	94.5
Combustible consumed (apparent)	440.5
Water pumped into boiler from hot well	2,713.02
Water pumped into boiler from auxiliary tank	444.00
Total water pumped into boiler	3,157.02

Evaporation:

Per pound of coal, from 62°	5.901
Per pound of combustible, from 62°	7.17
Per pound of combustible, from and at 212°	8.68
Total time of firing, in hours	$2\frac{1}{6}\frac{5}{0}$
Coal consumed per hour, in pounds	232.62
Coal consumed per hour per square foot of grate, in pounds	25.85

Soon after starting on the run, the gauge-glass burst, the automatic valves closing immediately, and during the rest of the trial the water-level was regulated by the gauge-cocks.

Ten runs were made over the measured mile, five with and five against the wind and tide, and then two, over a measured course of 3 nautical miles, one with and one against the wind and tide, the speed increasing from 13 to 15 statute miles per hour. The engines were not slowed at any time between the runs, nor in turning. There was no evidence of priming, nor was any water carried over to the engines, although there must have been considerable variation in the height of water in the boiler.

Steam blown through the gauge-cocks appeared to be dry. At 11.24½ a. m., the gauge indicating then 190 pounds, the engines were stopped, the fire burning actively. The auxiliary pump was put on, the jet closed, and the furnace door opened; the steam-pressure fell so rapidly, however, with the bleeder-pipe open, that the door was closed very soon after. There was no lifting of the water or other evidence in the behavior of the boiler that would indicate any more tendency to disastrous results of any kind than in the ordinary shell boiler. Apparently dry steam only was blown through the gauge-cocks, which were frequently opened during the stoppage.

At 11.34½, the engines were again started and the jet put on, the steam-pressure beginning to rise immediately from 185 pounds. At 11.35½, went ahead at full speed. From 12.25, when the last coal was put in the furnace, until 1 p. m., the average pressure maintained was 195 pounds.

At 1.04 the valves were reversed from full speed ahead to full speed astern, the engines backing in 15 seconds, with steam at 150 pounds. Several other trials in backing and also in turning were made, the boat beginning to back from full speed ahead in little more than half her length. The diameters of the turning circles were about twice the length of the boat. She was easily handled, being light; the engines worked without a hitch, the bearings ran cool and required little attention. At 1.21 p. m., the launch was brought alongside the wharf, the steam-gauge showing 70 pounds. The water was left at the bottom of the gauge, apparently. The dry ashes were weighed, the furnace having been well cleaned.

In the *Jersey Lily* the top of the boiler-casing is easily removable, so that by disconnecting the separator and pipes in front, the whole boiler can be readily lifted out (a space above equal to the height of vertical tubular elements being required to do this) and any tube removed.

In the larger boiler, arranged for higher power, while the principle is the same in every respect, there are some differences in the details of construction. The steam-drum is placed within the rectangular casing and the separator at the back of the boiler, so as to leave the front of the casing free for removal. There are four horizontal elements in the feed-water heater, instead of three, and seven tubes in each vertical element, instead of five. All tubes are 2 inches in internal diameter, and are joined to U's and elbows by right and left hand threads. The vertical elements connect directly (without the interposition of Y's) to short tubes in the steam and mud drums, being secured to them by heavy union-couplings, the nuts of which are fitted with lugs on top for spanners. The joint is made with asbestos washers. The holes in the drums are zigzagged. The casing is a single shell, with inside T-irons securing a lining, 2½ inches thick, of "Magnesia" bricks.

A boiler of this kind, designed to develop from seven to eight hundred horse-power, is being put in the yacht *Say When*, launched by the Herreshoff Company on April 24. Its grate-surface is 57 square feet, and the casing rectangular, about 8½ by 8½ by 8½ feet high. The construction in all details seems to be substantial. Owing to the large number of joints in contact with the fire, the liability to leakage is increased, but, on account of the facility with which any one element can be removed, the force of any objection on this score is reduced to a minimum. In case one or several of the elements are removed, the holes can be closed by caps and the rest of the boiler continued in use.

The computed weight of this boiler, with its attachments, is between 11 and 12 tons net. The space required in front for removal of the elements would be only 7 feet, or less than the usual width of fire-rooms.

We are of the opinion that this type of boiler is well adapted for large powers, and see no reason why any number of boilers, each complete in itself as described, with regulating check-valves for the control of the feed-water supply, should not be successfully arranged in batteries and in separate compartments. It is not yet certain whether it will operate satisfactorily with a powerful forced draft and highest rate of combustion, but its performance in the *Jersey Lily*, when in free route, indicated that even a higher rate of combustion than was secured would not have caused prejudicial results. When the *Say When* is completed, there will be an excellent opportunity to further test this question, as a powerful blower is supplied to force the combustion to the high rate that is expected, and which, in fact, will be necessary to produce the horse-power anticipated.

The class of skilled labor required for the proper care of the boiler when in use, and for repair and renewal of parts when found defective, can be generally found, in our opinion, on board our naval steamers, the character of the work being mainly pipe-fitting.

On April 24, in accordance with the expectations and wishes of the Messrs. Herreshoff, we made the trial with the old type of boiler in *Our Mary*. This trial was mainly for the purpose of observing the general working of the boiler in order to institute a comparison of the care and attention required in the two types; but, as before described, an evaporative and four calorimetric tests were also made. The trial lasted four hours, the fire burning for forty-five minutes after the last coal was put in the furnace.

The following table gives the results:

EVAPORATIVE TEST OF THE BOILER OF "OUR MARY", AT BRISTOL, R. I., APRIL 24, 1888.

[All weights are in pounds and all temperatures in degrees Fahrenheit.]

Totals.	
Duration of trial, in hours	4.00
Coal consumed	324.00
Refuse from coal	63.35
Combustible consumed	260.65
Water evaporated, by tank measurement	2,310.00
Averages.	
Temperature of feed-water	64.6
Temperature of atmosphere	49.6
Pressure of steam by gauge	112.0
Ratios.	
Coal per square foot of grate, per hour	9.00
Combustible per square foot of grate, per hour	7.22
Water evaporated from 64.6°, per pound of coal	7.13
Water evaporated from 64.6°, per pound of combustible	8.86
Water evaporated, equivalent to, from and at 212°	10.59

The observed data and computed results of the calorimetric tests are given in the following table:

Calorimeter tests of Herreshoff boiler (old type) in launch Our Mary, at Bristol, R. I., April 24, 1888.

Number of test.	Time. At beginning of test.	Time. At end.	Steam pressure by gauge. At beginning.	Steam pressure by gauge. At end.	Weight of empty barrel. b.	W + b.	W.	W + b + w.	w.	Temperatures. Final. t'.	Temperatures. Initial. t.
1*	A. M. 11.02	A. M. 11.29	97	130	39.7	196	150.3	206.2	10.2	111.1	44.0
2	A. M. 11.50	P. M. 12.11	155	125	30.8	196	156.2	205.75	9.75	111.3	45.4
3	P. M. 1.30	1.51	115	115	39.8	195	155.2	204.6	9.6	111.8	46.9
4	2.08	2.31	105	112	39.8	195	155.2	204.8	9.8	112.0	45.7

* Slowed engines during test owing to water in cylinder.

Calorimeter tests of Herreshoff boiler (old type) in launch Our Mary, etc.—Continued.

No. of test.	Units of heat.						Q.
	h'.	*h*.	*h'*-*h*.	*l*.	T.	T-*h'*.	
1	79.2001	12.0006	67.1995	869.4661	318.0155	238.8154	.9095
2	79.4008	13.4009	65.9999	859.7610	332.1875	252.7867	.9358
3	79.4008	14.9003	64.5005	868.8159	318.9377	239.5369	.9245
4	80.1032	13.7009	66.4023	871.6488	314.9190	234.8158	.9371
					Average Q		.927

From the average value of *Q*, it will be seen that the moisture was 1.0—0.927=0.073, or 7.3 per cent., which is more than twice the amount found in the boiler of the *Jersey Lily*.

To determine the equivalent evaporation, had all the heat absorbed by the water in the boiler been utilized in producing dry steam, we have the following data and the computations therefrom:

Average steam pressure, absolute (p)	126.7
Temperature corresponding to this pressure (t)	345.15
Units of heat in 1 pound of steam at pressure p, from 32°	1187.2107
Units of heat in 1 pound of water at pressure p, from 32°	317.0975
Units of heat in 1 pound of water at temperature of 64.6°	32.6091
Total weight of feed-water of a temperature of 64.6°	2310.0

1187.2107—32.6091=1154.6016=units of heat required to convert 1 pound of water at 64.6° into steam at pressure p; 317.0975—32.6091=284.4884=units of heat required to raise 1 pound of water from 64.6° to temperature t.

But only 0.927 of the water fed to the boiler was converted into steam, the remainder 0.073, passing over as moisture of a temperature t.

Therefore 2310×0.927=2141.37 pounds of water converted into steam. This required an expenditure of 2141.37×1154.6016=2472428.5858 units of heat.

To raise the remaining water from 64.6° to the temperature t, required (2310—2147.37)×284.4884=47973.2283 units of heat.

Therefore there was absorbed by the 2310 pounds of water fed into the boiler a number of units of heat equal to 2472428.5858+47973.2283=2520401.8141, and hence (2520401.8141×260.65)÷1154.6016=8.83=equivalent evaporation per pound of combustible from 64.6° and under an absolute pressure of 126.7 pounds.

And (8.83×1154.6016)÷965.7=10.557=equivalent evaporation from and at 212°.

The excessive moisture shown by the calorimetric tests in the above case was plainly evident from the working of the engines during the trial, as these had to be slowed several times on account of water in the cylinder. This excess was, no doubt, due to slight variations in the water-level, although the closest attention was given to its regulation. It is in this particular, as well as in facility for repairs, that the new type is superior to the old one.

Very respectfully,

A. S. GREENE,
Chief Engineer, U. S. Navy.
C. W. RAE,
Passed Assistant Engineer, U. S. Navy.
F. C. BIEG,
Assistant Engineer, U. S. Navy.

Engineer-in-Chief GEORGE W. MELVILLE, U. S. Navy,
Chief of Bureau of Steam Engineering, Navy Department, Washington, D. C.

REPORT OF A BOARD OF U. S. NAVAL ENGINEERS ON THE HOHENSTEIN MANUFACTURING COMPANY'S ENGINE AND STEAM-GENERATOR, MADE TO THE BUREAU OF STEAM ENGINEERING, NAVY DEPARTMENT, MAY 12, 1888.

OFFICE OF THE HOHENSTEIN MANUFACTURING COMPANY,
Newark, N. J., May 12, 1888.

SIR: In obedience to the Bureau's order of April 16, 1888, we have examined and made such tests as limited time and means permitted of the engine and generator built by the Hohenstein Manufacturing Company, of Newark, N. J., and have the honor to report upon the adaptability of the same for the naval service.

The engine is a single-cylinder compound inverted half-trunk type. The bed-plate is of cast-iron and dished directly under the crank to catch drippings of oil. The forward and after part of the bed-plate is a flat surface upon which are secured the main bearings, feed and air pumps. A crank on the forward end of the shaft drives the feed, air, and naphtha pumps. The latter is placed in the naphtha tank and connected to motion by a rod. The cylinder rests upon four iron columns secured to the bed-plate. The piston and trunk are in one casting; the latter passes through the lower end of the cylinder, and is fitted with a stuffing-box. The space between the trunk and the cylinder is the high-pressure end; and the upper end the low pressure. The steam is admitted and exhausted from both ends of the cylinder by an oscillating valve driven by one eccentric secured to a slip-sleeve and wheel, fitting loosely on the shaft, and having the required stops. In working the engine the sleeve is brought up against one of the stops, placing the eccentric in backing or ahead position. In addition there is a small by-pass valve for admitting steam directly to the steam-port of high-pressure cylinder.

The trunk pin, to which the upper end of connecting rod is attached, is secured to the piston, and is lubricated through a tube having the same motion as the piston, passing through the top cylinder head. Over the oil-tube is a stand-pipe, the bottom of which forms a gland to keep the oil tube tight. The upper end is open for supplying the necessary amount of oil.

Steam is first admitted into the lower or high-pressure end of the cylinder, and after performing its duty it passes into the upper or low-pressure end. Through a cylindrical feed water heater it exhausts to a pipe condenser secured to the keel of the boat. This pipe condenser commences amidships on the starboard side and extends around the stern and on the port side for the same distance. The connection to the air pump is made near the stern. The thrust is taken on a brass casting secured to the stern post, against which the hub of the propeller rests. The piston is packed with "Eureka" packing.

The advantages of this engine are reduced height, as compared with cross-head engines of the same length of connecting rod, and less number of moving parts.

The objections are, its liability to hang on the center, the losses by radiation from the trunk, and condensation due to difference of temperature in the cylinder during each revolution.

THE GENERATOR.

The generator in its general form is a vertical cylinder, as shown by the accompanying plate. The base-plate is a square with a circular flange to which is secured the outside casing. In a central position is a cylindrical chamber into which is secured a vertical tube closed at both ends, extending into the smoke-pipe. Into the chamber below the vertical tube the naphtha vapor is conducted by a pipe leading from the retort. Into this chamber are tapped twenty small perforated pipes extending radially; through them the naphtha passes into the combustion chamber. The space in the base-plate between the chamber and the flange has suitable openings for the admission of air into the combustion chamber. Surrounding the central tube and secured to it (near the upper and lower ends) by brass nipples are twenty spiral copper tubes. Around these tubes is a cylindrical casing consisting of light Russia iron for outside, then an air space of one-eigth inch between it and an inside sheet-iron casing. Inside the inner casing is a lining of asbestos.

In the top of the central tube is tapped a steel pipe; coiling down and around the tube, it then passes through the casing to the engine.

The feed water is forced into the lower end of the central tube, and thence passes into coil copper tubes and is maintained at a level with their upper openings. The upper part of the central tube is a steam drum; this surface and the coil steam-pipe is exposed to the escaping gases from the furnace, which superheat the steam to an

extent we were unable to ascertain for want of suitable appliances. The water gauge is placed on the outside casing and connected to the central tube.

The retort is a vertical steel tube placed inside the casing, and extends through it near the base of the smoke-pipe. At that point it connects, through two right-angled turns, to an injector (with an opening to the air) which discharges the vapor and air through a return pipe to the chamber, and thence to the burners.

Two feed-water tanks are placed in the boat, each having a division plate near one end extending from the top, with an opening into the main tank near the bottom. The air pump discharges the water into the smaller division and it then flows through the opening in the division-plate into the main tank, to which the suction pipe of the feed pump is connected. The oil floats on top of the water in the smaller section and is prevented from reaching the generator.

The feed-water heater consists of two pipes of different diameters. The inner pipe is a part of the exhaust pipe leading to the condenser and the feed water is pumped into the annular space between the pipes, and thence to the generator.

Two small hand-pumps are fitted in the boat, one to supply air to the naphtha tank and the other to supply water to the generator when the engine is at rest.

The naphtha tank is placed in the bow of the boat, and the discharge pipe from the pump is led to the outside of the boat alongside the keel to a point directly under the generator, where it passes through the hull and connects with the retort. This precaution is used to prevent any leakage of naphtha inside the boat.

In starting the generator, air is forced into the naphtha tank by the hand-pump, where it mixes with the naphtha vapor; it is then conveyed through a pipe to the furnace and ignited. After the engine is in motion the naphtha pump forces the naphtha into the retort. The latter pump can also be operated by hand when the engine is stopped.

During the trial the water in the glass gauge dropped whenever the engine was stopped and the supply of naphtha cut off, and would rise again when the engine was put in motion. This was probably due to two causes: first, the water-gauge pipe was connected to feed pipe and the force of the water in its passage to the central tube probably caused the rise in the gauge glass; second, a portion of the water in the coil tubes was probably thrown out, by the rapid generation of steam, into the central tube. The facts can only be ascertained by making the connection between glass water-gauge and feed independent, and placing test cocks on one or more of the coil tubes. A possible cause affecting the durability of the generator is that the oil used in the cylinder of a condensing engine may find its way with the feed water into the generator, clogging and coating the surface of tubes to such an extent as to destroy them.

Only a long trial will demonstrate whether the means they have adopted to separate the oil from the feed water will accomplish it.

The advantages of this generator are rapidity in generating steam, requiring only three minutes to raise steam from cold water to a pressure of 100 pounds per square inch; lightness as compared with boilers used in the naval service; large amount of heating service in proportion to space occupied, and we believe it impossible for it to explode with any serious results. The Hohenstein Manufacturing Company has designed a coal-burning generator with larger tubes and of a size more suitable for the launches used in the naval service.

As it is this size or one still larger that the company desires tested, the Board would suggest that, if a trial be made, the circulation in the coil tubes be ascertained and the trial be sufficiently long to demonstrate its durability. There is no question that with this kind of generator it is necessary to use pure water.

Four of the generators of this type have been completed, two are in the small launches now at the works, which have been but little used; one in the shop furnishing power, used since February last, and one in the private boat belonging to Mr. Ofeldt, the designer, used since April, 1887; all of these are said to have given satisfaction.

Two trials were made: the first to test the power of the engine. The boat was steamed back and forth on the Passaic River, and cards were taken sufficiently often to ascertain the power of the engine. (See Table I.)

The second trial was to test the efficiency of the generator. Connection was broken between the feed-pipe and feed-water tank, and connection made to an open vessel into which the water was measured. The naphtha tank was emptied and the amount placed in it carefully weighed, and the engine was kept in motion until the naphtha was exhausted. (See Table II.)

An additional trial was attempted in order to ascertain the evaporation at atmospheric pressure. The safety valve was removed so that the steam generated could pass directly to the air, but the experiment failed of accomplishment on account of water passing out with the steam in large quantities.

The Board did not, for the following reasons, deem it necessary to make more extended trials. First, the Hohenstein Manufacturing Company were not desirous that trials should be made with the size of generator used, but would prefer a trial with

a larger size fitted for burning coal; second, the one tried is designed for burning naphtha only—a fuel that would not be used in the naval service; third, the engine and pipes were not clothed nor fitted with appliances for ascertaining the temperature of the feed water passing through the heater, nor the temperature of the products of combustion entering the smoke-pipe. There was no counter attached and the revolutions varied with the slightest movement of persons in the boat, so that it was impossible to ascertain the total number of revolutions of the engine. At the time the cards were taken the moving weights were kept quiet, and the revolutions taken with a speed indicator.

DIMENSIONS AND WEIGHTS.

Engine.

Diameter of cylinder	inches..	6¼
Diameter of trunk	do....	5¼
Diameter of piston guide through cylinder head	do....	¾
Stroke of piston	do....	5¼
Area of high-pressure end of cylinder (net)	square inches..	11.54
Area of low-pressure end of cylinder (net)	do....	32.74
Clearance between piston and bottom of cylinder	inch..	¼
Clearance between piston and top of cylinder	do....	$\frac{3}{16}$
Total clearance space at lower end of cylinder	cubic inches..	6.142
Total clearance space at upper end of cylinder	do....	9.815
Area of steam-port	square inch..	.94
Area of exhaust-port	do....	.94
Inside diameter of steam-pipe	inch..	¼
Inside diameter of exhaust-pipe	do....	1
Length of connecting rod	do....	13
Length of pipe condenser	feet..	21
Inside diameter pipe condenser	inches..	1.12
Outside diameter pipe condenser	do....	1.25
Area of condensing surface	square feet..	6.56
Diameter of air-pump	inch..	.81
Stroke of air pump	do....	4.00
Diameter of feed pump	do....	.62
Stroke of feed pump	do....	1.00
Diameter of naphtha pump	do....	.5
Stroke of naphtha pump	do....	.5 to 2
Throw of eccentric	do....	2¼
Length of valve arm	do....	2¼
Lap of valve	do....	.6
Weight of engine and pumps complete	pounds..	175
Weight of trunk, piston, and connecting rod, complete	do....	21
Height of engine	inches..	27
Length of engine	do....	18
Width of engine	do....	13

Generator.

Diameter of casing, exterior	do....	14¼
Diameter of casing, interior	do....	13¾
Height of top of smoke-pipe above grate	do....	56
Height of shell from base plate to junction of smoke-pipe	do....	36
Height of smoke-pipe above shell	do....	25
Diameter of smoke-pipe, interior	do....	7
Diameter of grate or burner	do....	13
Area of grate or burner	square inches..	133.4
Dimensions of base plate 15 inches square, thickness	inches..	¼
Height of boiler over all	do....	61
Length of central tube above water line	do....	17
Diameter of central tube (inside)	do....	3
Diameter of central tube (outside)	do....	3¼
Coil tubes	number..	20
Length of each coil tube	feet..	12
Diameter of coil tubes (outside)	inch..	⅝
Diameter of coil tubes (inside)	do....	⅜
Area of heating surface	square feet..	27.5
Area of superheating surface	do....	2.25
Distance from grate to lower part coil tubes	inches..	5
Height of water above lower part of coil tubes	do....	26
Height of burner above base plate	do....	2¼
Distance between upper and lower coil connections	do....	26
Capacity of steam drum	cubic inches..	120.16
Capacity of naphtha tank	gallons..	50

Capacity of water tank	gallons..	25
Weight of water in generator	pounds..	13
Weight of water in tank	do....	200
Weight of naphtha in tank	do....	300
Pressure at which generator was tested	do....	300
Weight of generator complete	do....	160

Screw propeller.

Blades	number..	2
Diameter	inches..	21
Pitch	do....	42
Helicoidal surface	square inches..	100

Dimensions of boat.

Length over all	feet..	25
Length on keel	do...	22
Breadth of beam	do...	5
Draught	inches..	21

TABLE I.—*Trial of the steam-launch engine and generator of the Hohenstein Manufacturing Company, Newark, N. J., May 3, 1888.*

Hour.	Steam pressure per square inch above atmosphere.	Vacuum in inches in condenser.	Revolutions of engine per minute.	Mean effective pressure. High pressure end of cylinder.	Mean effective pressure. Low pressure end of cylinder.	Indicated horse-power. High pressure end of cylinder.	Indicated horse-power. Low pressure end of cylinder.	Total horse-power developed by the engine.
11.40 a. m	110	10	248	40.20	10	1.60	1.12	2.72
11.50 a. m	105	10	252	38.40	10.14	1.56	1.16	2.72
3.20 p. m	100	10	228	35.20	10.40	1.29	1.08	2.37
3.30 p. m	105	10	272	39.60	12.20	1.73	1.50	3.23
3.35 p. m	100	10	240	36.00	11.22	1.38	1.22	2.60
3.40 p. m	125	10	268	36.20	12.50	1.55	1.52	3.07
3.45 p. m	110	10	244	40.80	11.50	1.60	1.27	2.87
3.52 p. m	95	10	236	35.40	12.05	1.34	1.28	2.62
Averages	106.25	10	248.5	37.75	11.25	1.51	1.27	2.775

Hour.	Pounds of steam per hour in cylinder at point nine-tenths of the stroke from beginning. High pressure end of cylinder.	Pounds of steam per hour in cylinder at point nine-tenths of the stroke from beginning. Low pressure end of cylinder.	Pounds of steam per hour, retained in cylinder by compression. High pressure end of cylinder.	Pounds of steam per hour, retained in cylinder by compression. Low pressure end of cylinder.	Pounds of steam per hour, exhausted from cylinder. High pressure end of cylinder.	Pounds of steam per hour, exhausted from cylinder. Low pressure end of cylinder.	Pounds of steam per horse-power per hour.
11.40 a. m	72.460	82.168	6.094	11.356	66.366	70.812	26.03
11.50 a. m	68.717	90.586	6.687	8.934	62.030	81.652	30.02
3.20 p. m	59.942	69.062	3.652	5.846	56.290	63.216	26.67
3.30 p. m	78.197	90.129	5.118	9.419	73.079	80.701	24.98
3.35 p. m	65.445	76.092	3.914	6.825	61.531	69.271	26.64
3.40 p. m	83.499	96.338	4.769	8.456	78.730	87.882	28.69
3.45 p. m	72.144	80.844	4.342	8.449	67.802	72.395	25.22
3.52 p. m	66.650	78.200	3.970	6.720	62.680	71.480	27.21
Averages	70.882	82.927	4.818	8.251	66.064	74.676	26.91

NOTE.—Difficulty was experienced in taking cards from the high pressure end, owing to presence of water in cylinder.

TABLE II.—*Trial of the steam generator made by the Hohenstein Manufacturing Company, Newark, N. J., May 4, 1888.*

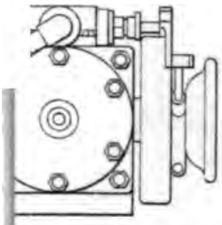
Average steam pressure per hour	pounds..	60
Naphtha consumed per hour	do...	8.25
Water evaporated per hour	do...	125.61
Water evaporated per pound of naphtha consumed	do...	15.23
Temperature of water in generator at beginning of experiment		212° F.
Temperature of water in generator at end of experiment		212° F.
Temperature of naphtha		61° F.
Temperature of feed water		60° F.
Temperature of atmosphere		56° F.

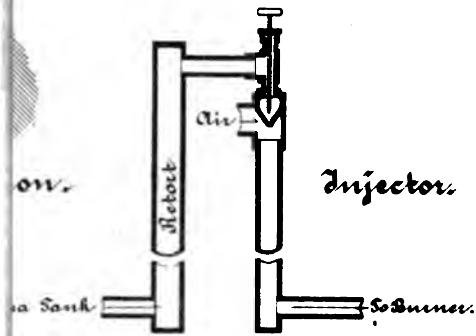
Very respectfully submitted,

W. W. DUNGAN,
Chief Engineer, U. S. Navy.
A. B. CANAGA,
Passed Assistant Engineer, U. S. Navy.
J. L. WOOD,
Assistant Engineer, U. S. Navy.

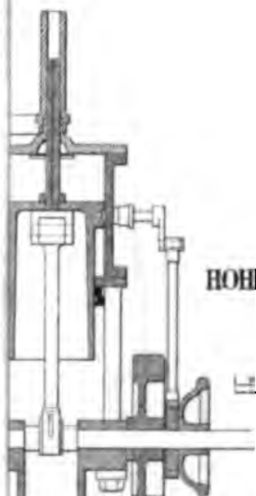
Engineer in chief GEORGE W. MELVILLE, U. S. N.,
Chief of Bureau of Steam Engineering, Navy Department, Washington, D. C.

Plate 4





Injector.



HOHENSTEIN ENGINE
AND
GENERATOR.

Scale of Inches.

Photo-Lith. by A. HOEN & CO.

ACT FROM THE REPORT OF A BOARD OF UNITED STATES NAVAL INEERS ON BOILER TESTS OF U. S. S. SWATARA, MADE TO THE EAU OF STEAM ENGINEERING, NAVY DEPARTMENT.

NAVY YARD,
Portsmouth, N. H., February 21. 1888.

In accordance with the instructions of the Bureau, contained in a letter to mmandant of this yard, dated November 28, 1887, and also a letter to the member of the board, dated January 26, 1888, we have made a careful test of tential and economic performance of the boilers of the United States steamer a, and report as follows:

Board reported for this duty on February 1, and fires were started in one n that day, but various minor defects, of a character to vitiate the results of its and which were mainly due to freezing during the severe weather of the ing week, required remedying and delayed operations until Wednesday, Feb- , when the preliminary run of twelve hours was made. The other tests fol- each day until Saturday, when the last one was completed.

boilers of the *Swatara* are six in number, arranged three on each side of a fore- fire-room, as is common in vessels of the naval service. They are alike, with eption provided for in the different tests, and are cylindrical, 9 feet in length eet in diameter, with two cylindrical furnaces 6 feet 3 inches long by 2 feet 10 in diameter. The bridge walls are near the back ends and limit the length of to 5 feet 6 inches. Each boiler contains 166 horizontal tubes, 2¼ inches in di- and 6 feet 3 inches long, arranged in two nests directly over the furnaces. The nnection as built is common to both furnaces, but has been separated into two ne for each furnace, by means of a diaphragm plate bolted up by suitable lugs d for that purpose. Within the boilers, circulating plates are fitted to both each nest of tubes, extending from the front heads to the back tube sheets m the bottom to the top of the nests, for the purpose of confining the circula- the water to the upward currents among the tubes, and to downward cur- t each side of the boiler and between the nests of tubes and furnaces.

st is supplied to the furnaces of the three boilers on either side by a 5-foot ant blower. The two blowers are located one on each side of the fire-room, ess forward of the boilers, and secured to the deck-beams and bulkheads high to leave a clear floor space and passage to the coal bunkers, fire-room ladder, ward auxiliary pump. The conduits lead down through the floor and along ter keelsons and have branches, with necessary dampers, to the fronts of the s. A peculiarity in connection with the blast arrangement is a simple device ch a portion of the direct blast is admitted between the furnace doors and nings, by reason of which there is no escape of the gaseous products of com- from the furnaces around the doors into the fire-room, but instead only the r of the blast can find passage there, an important consideration in its relation omfort and health of the men employed in the fire-room and in the preserva- the doors and linings from warping and burning out.

rincipal dimensions and proportions of each boiler are as follows:

of boiler	feet..	9
er of boiler	do....	9
es	number..	2
of furnaces	feet..	6¼
er of furnaces	inches..	34
of grates	feet..	5½
ı of grates	inches..	34
urface in one boiler	square feet..	31.163
n one boiler	number..	166
of tubes	feet..	6¼
er of tubes	inches..	2¼
eating surface in one boiler	square feet..	727.135
opening through tubes	do....	4.719
apacity of one boiler to 6 inches above tubes	cubic feet..	225.65
apacity of one boiler from 6 inches above tubes	do....	131.55
n of grate to heating surface		1:23.33
n of opening through tubes to grate surface		1:6.6

For the purpose of evaporative tests, two tanks were provided for measuring the water pumped into the boiler. These tanks were located in the forward part of the drum-room on the berth-deck; No. 1, of 32.03 cubic feet capacity, on the starboard side, and No. 2, of 32.45 cubic feet capacity, on the port side. They were connected at their bottoms by a cross-pipe with two gate-valves, between which was a T connection for pipe to forward auxiliary pump, which pump was used for feeding the boiler. The tanks were first filled from the yard hydrant by means of a hose and the boilers filled from them for starting, after which the hose was led down to the hot-well reservoir of the engine and the waste supplied there, the hose being shifted to the calorimeter when water was required for that purpose, so that a constant flow was kept up through the hose to prevent freezing. Thermometers were placed in the engine-room, fire-room, on deck, in each measuring-tank, and in the steam-pipe, and a pyrometer was fitted in the up-take directly over the boiler under trial.

All the coal used during the experiments was weighed on platform scales, and for convenience put into bags holding 150 pounds, net, each. All the ashes and refuse from the fires were weighed dry on other platform scales in the fire-room. For testing the quality of the steam as to dryness, a calorimeter was provided, which consisted of a clean alcohol-barrel of about 50 gallons capacity, from which the upper head had been removed. This was placed on platform scales (which were adjusted to weigh one-tenth of a pound), and a standard and very sensitive thermometer (measuring one tenth degrees) was used for taking the initial and final temperatures of the water in the barrel. A drain-valve was attached to the lower head of the barrel, by means of which it could be drained after each test. The steam to be tested was drawn from the center of the main steam-pipe through a 1-inch pipe inserted and secured in the inlet-nozzle of the separator. This pipe was 6 feet in length and well clothed to prevent loss of heat by radiation, and a hose was coupled to it for admitting steam to the water in the barrel, and in the coupling was placed a diaphragm of thin copper with a one-eighth-inch hole, through which the steam was drawn.

The preliminary run of twelve hours on Wednesday, the 8th instant, was made with the starboard forward boiler, complete as described, and no difficulty was experienced, pumping and blowing having been resorted to for two hours previous to beginning. This run was attempted on the previous day, but violent priming resulted upon the fires being strongly urged, owing to the boiler being dirty.

The preliminary run having been completed and everything found in perfect order, the first regular test, made with the circulating plates in place, was started with the same boiler. In about an hour, the safety-valve lifting, such violent priming took place that the blast had to be shut off and the doors opened to arrest it. It was soon found that every time the safety-valve lifted the same difficulty was experienced, and it became necessary to limit the pressure to such a point that the safety-valve would not lift. The steam-gauge not being in sight from the regulating-valve, this was almost impossible of accomplishment, except by limiting the maximum pressure to 80 pounds, leaving a margin of 5 pounds for safety in this respect. With this precaution, the test was again started at 10.10 a. m. on Thursday, and completed at 10.10 p. m.

The coal used during all of the tests was average anthracite of fair quality, supplied by the regular Government contractor for steaming purposes, but the Board was unable to learn where or when it was mined. Although the coal was all taken from the same bin, that used on the test of the 9th was inferior to that used in the succeeding tests, in that it contained a much larger proportion of slack.

The manner of making the test was as follows:

The fires were spread, the blast turned on, and when the former had reached a full normal condition, the height of water in the boiler was marked on the gauge, a full tank turned on the feed-pump, the time noted, and the trial considered commenced. From this time all coal burned was accurately tallied, a system of checks rendering errors impossible. The time of emptying each tank was noted, care being taken to secure a full tank some time before the one being used was empty, and that the tanks were each time filled and emptied to the same points for which their capacities had been computed; and also, that in shifting from one to the other, the valves were properly set, so that accuracy in the measurements was secured. The steam was passed through the bleeder-pipe to the condenser, the port auxiliary pump being used to supply the necessary circulating water. The water from condensed steam, with the additional quantity supplied through the hose from the hydrant, was pumped into the measuring-tanks by the starboard auxiliary pump. The excess of water overflowing to the bilge was pumped overboard by the auxiliary pump in the shaft-alley. Gauges measuring the pressure of the blast in height of water column were attached to the main conduit, near the blower, to the ash pit, to the furnace door, to the furnace, and to the up-take, and carefully observed. The revolutions of the blower were frequently taken. An hourly record of all the quantities was carefully kept, the averages for the twelve hours being given in Table 2.

Calorimeter tests of the quality of the steam were taken each hour in the following

manner: The scales being adjusted, the weight of the empty barrel was taken, the barrel filled to within about 6 inches of the top with cold water from the hydrant-hose, the weight of the barrel and cold water taken, as well as the temperature of the water after it had been thoroughly agitated to secure uniformity. Steam was then allowed to flow through the pipe and hose into the atmosphere for a few minutes for the purpose of heating and to prevent condensation within it, and the hose then quickly placed in the water in the barrel and retained there until the temperature was raised to about 110° Fahrenheit. The hose was then removed, the water agitated, and the temperature and weight again taken as quickly as possible; after which the barrel was drained, allowed to stand for a few minutes, and was then ready for the succeeding test. All the tests were made in exactly the same manner, the weights being taken to one-tenth of a pound and the temperatures to one-tenth of a degree Fahrenheit. Twelve of these tests were made during the twelve hours run, and the observed data are given in Table 1. The quality of the steam was computed for each of these measurements separately, according to the formula.

$$Q=\frac{1}{l}\left[\frac{W}{w}(h'-h)-(T-h')\right]$$

The result of the twelve calorimeter tests gave 95.559 per cent. steam and 3.441 per cent. moisture.

The results of the evaporative trial, as observed and computed, are collected and arranged in Table 2. These results not having been entirely satisfactory, the rate of combustion having been limited by the constant tendency of the boiler to violent priming, and this with the circulating plates in place (which, it was supposed, would prevent the difficulty of priming), it was determined to repeat the trial after thoroughly cleaning the boiler and refilling it with fresh water. The trial was again started at 8.45 a. m. on the 16th and continued until 6.45 p. m., when it was discontinued, as part of the grate-bars at the back end of the forward furnace had melted down so as to leave a hole in the fire through which enough of the blast passed to materially reduce the coal consumption and especially the economic result of the evaporative test, for which reason it was deemed expedient to bring the trial to a close. For the first six hours of this run the blowers had averaged nearly 600 revolutions per minute, giving a blast pressure of 5 inches in main conduit and producing a coal consumption of 41.6 pounds per square foot of grate per hour, with an apparent evaporation of 6.17 pounds of water (from actual temperature of feed) per pound of coal. As everything worked well for the six hours considered, this result is believed to be a fair indication of what it is possible to maintain with this system of forced draft and trained firemen, but at the same time it is considered as entirely too severe on the boiler for regular working practice, for the intense heat (unless everything can be kept in the most perfect condition) is liable to injure the boilers or destroy the grate-bars, as finally happened in this case. The calorimeter measurements and the average data and results, computed and arranged for the ten hours, are given in Tables 3 and 4.

The second evaporative trial, with the forward port boiler, having the circulating plates removed, but in all other respects complete, was made on the 10th instant, and was conducted the same in every particular as the first one on forward starboard boiler, except that there was no priming or tendency to prime apparent.

The fires were much more strongly urged and a correspondingly higher rate of combustion secured and a higher potential but lower economic evaporation obtained. In these particulars, however, the results are much below those obtained in the repeated test, with the circulating plates in place, made on the 16th, in which the apparent evaporation is much higher than would be accounted for by the water carried over in the steam as shown by calorimeter measurements and which may have been due to violent priming at different times and of short duration. The increased combustion in the latter case was due to stronger blast and increased proficiency of the firemen. The calorimeter measurements, and the average data and results computed, collected and arranged, are given in tables 5 and 6.

In these tables, the terms refuse and combustible are used, and as they are to some extent at least misnomers, they might, without explanation, be misleading. We have named as refuse all the unconsumed coal and other material which fell through the grate bars and was hauled from the ash pits, while in fact there was but little refuse present in the form of ash or clinker and it nearly all consisted of unconsumed coal in small lumps, while much the greater part of ash and real refuse appears to have been blown out through the smoke-pipe, together with a small quantity of finely divided and unconsumed coal. We have called combustible that which remained after deducting the weight of material from ash pits and cleaning fires from the weight of coal fed to fires, according to the usual practice.

All the instruments used worked satisfactorily, except the steam-pipe thermometer, which leaked steam around its tube and made a deposit on the glass front of the case so that its reading could not be taken until this glass front was broken, when the

readings were found to be considerably below what they should be, owing probably to the fact that the bulb end of the stem was too short to reach sufficiently into the interior of the steam-pipe. The pyrometer for uptake indicated satisfactorily during the trials of the 9th and 10th instants, but the latter date it became deranged and no longer furnished any indications, but from what cause is unknown.

The third test for the purpose of determining whether, with the diaphragm plate removed from the back connection, the operations of firing, cleaning of fires, etc., could be performed in one furnace while the blast was on the other, was made on the after starboard boiler on the 11th instant. For this purpose the diaphragm plate was removed, steam raised on the boiler, and a moderate blast used to put the fires in the condition of ordinary working practice. The blast was then reduced to a pressure in the main conduit of 1 inch of water and closed off from one furnace and the door of that furnace opened; the blast was then gradually increased up to 2½ inches of pressure. The same thing was then done to the other furnace with like results in the two cases.

At 1 inch pressure in main conduit there was but a moderate discharge of furnace gases into the fire-room, and the fires could be worked with little inconvenience; at 1½ inches pressure, there was a constant escape of gas with flame, extending up the boiler front for about 3 feet, and sufficient to entirely prevent working in front of the fires; at 2 inches pressure of blast in main conduit the flame was projected in a curve to beyond the middle of the fire-room and as high as the spar deck, with so much heat that it would have been difficult to pass on the opposite side of the fire-room, and with 2½ inches pressure in the main conduit, a solid column of white flame was projected entirely across the fire-room with very intense heat. These results indicate beyond question that it would be entirely impracticable to omit the diaphragm plates from the back connections. It may be further remarked that when the blast was at a pressure of 5 or 6 inches, even with the diaphragm plates in place, the leakage past it was sufficient to project a good deal of gas and very uncomfortable flame out of the furnace door when working the fires.

Respectfully submitted,

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Chief Engineer, U. S. Navy.
J. L. D. BORTHWICK,
Chief Engineer, U. S. Navy.
A. PRICE,
P. A. Engineer, U. S. Navy.

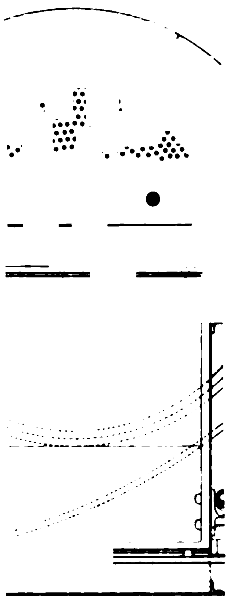
Engineer-in-Chief GEO. W. MELVILLE, U. S. N.,
Chief of the Bureau of Steam Engineering,
Navy Department, Washington, D. C.

TABLE 1.—*Calorimeter measurements, evaporative test, U. S. S. Swatara, with circulating plates in place, navy-yard, Portsmouth, N. H., February 9, 1888.*

No. of test.	Time of beginning test.	Steam pressure during test.	Weight, in pounds, of— Empty barrel.	Barrel and water.	Water (W).	Barrel, water, and condensed steam.	Condensed steam (w).	Air at calorimeter.	Temperature of— Steam in main steam pipe.	Water, initial (t).	Water, final (t').	t'—t.	Percentage of— Saturated steam 100 Q.	Moisture 100 (1—Q).
	A. M.													
1	11.42	74.5	61.9	410.2	345.3	435.5	25.3	90	310	36.4	114.5	78.1	96.509	3.491
	P. M.													
2	12.55	78	65.0	402.0	337.0	424.0	22.0	90	309	36.1	106.3	70.2	96.544	3.456
3	1.42	77	65.2	406.6	341.4	433.1	26.5	93	310	36.0	118.1	82.1	95.914	4.086
4	2.54	76.5	65.1	405.7	340.6	427.5	21.8	94	311	36.0	106.0	70.0	98.630	1.370
5	3.47	76	65.4	403.0	337.6	424.7	21.7	88	315	35.8	105.6	69.8	97.703	2.297
6	4.26	78	65.6	402.0	336.4	423.3	21.3	87	311	35.9	104.7	68.8	97.633	2.367
7	5.12	77	65.5	402.0	336.5	424.6	22.6	86	310	35.3	107.3	72.0	96.313	3.687
8	6.10	76	65.5	402.0	336.5	425.2	23.2	83	309	35.4	108.7	73.3	95.633	4.367
9	6.53	77	65.6	403.0	337.4	425.4	22.4	85	309	35.0	106.2	71.2	96.236	3.764
10	7.35	77	65.6	402.0	336.4	424.9	22.9	83	311	35.0	107.9	72.9	96.252	3.748
11	8.36	77	65.6	406.0	340.4	428.2	22.2	84	305	33.3	102.6	69.3	94.720	5.280
12	9.19	77	65.7	402.0	336.3	424.3	22.3	88	306	35.6	106.9	71.3	96.631	3.369
	Averages												96.559	3.441

Blakes

na.



Furnaces of U.S.S.S

Arranged for Forced D

esults of evaporative tests on boiler of U. S. S. Swatara, with circulating plates in place, navy-yard, Portsmouth, N. H., February 9, 1888.

xperiment, in hours	12
boiler ......cubic feet..	1,010.33
boiler ....pounds..	63,006.65
d ....do....	9,300
al in ashes, etc..do....	1,694
onsumed........do....	7,606
al. ....per cent..	18.21
Fahrenheit, of—	
ir............degrees..	15.4
....do ...	74.70
ank No. 1 ....do....	53.75
ank No. 2 ....do....	53.07
ain steam-pipe..do....	309.4
of combustion in up- ....degrees..	703.3
inches of mercury......	29.97
n—	
n inches of water.......	2.87
inches of water.......	2.08
oor frame, in inches of	1.86
n inches of water.......	1.63
inches of water......	0.13
f blowing engines per	438.6
per hour pounds..	775
per square foot of grate ... pounds..	24.87
nsumed per square foot hour ....pounds..	20.34
oration per tank meas- m 53.41° F. and under essure, per pound of coal	6.775

Apparent evaporation, under same conditions as above, per square foot of grate per hour	168.503
Equivalent apparent evaporation from 212° F. and under atmospheric pressure, per pound of coal consumed	8.131
Equivalent apparent evaporation from 212° F. and under atmospheric pressure, per pound of combustible consumed	9.929
Actual equivalent evaporation from 212° F. and under atmospheric pressure, per pound of coal consumed, being apparent evaporation less the water carried over by priming, as shown by calorimeter measurements	7.851
Actual equivalent evaporation from 212° F. and under atmospheric pressure, per pound of combustible consumed, being apparent evaporation less the water carried over by priming, as shown by calorimeter measurements	9.587
Equivalent evaporation from 212° F. under atmospheric pressure, per pound of combustible consumed, had all the heat carried over by priming been utilized in vaporizing water	9.6818

alorimeter measurements, evaporative test, U. S. S. Swatara, with circulating ace (repetition of test of February 9), *navy-yard, Portsmouth, N. H., Feb-* 888.

	Weight, in pounds, of—					Temperature of—					Percentage of—	
	Empty barrel.	Barrel and water.	Water (W).	Barrel, water, and condensed steam	Condensed steam (w).	Air at calorimeter.	Steam in main steam-pipe.	Water, initial (t).	Water, final (t').	t' — t.	Saturated steam 100 Q.	Moisture 100 (1—Q).
.5	64.5	405.9	341.4	429.4	23.5	75	290	35.4	105.9	70.8	91.207	8.793
.2	64.5	406.5	342.0	430.5	24.0	84	293	38.0	111.0	73.0	93.117	6.883
.5	64.6	403.0	341.4	429.7	23.7	83	295	35.4	108.6	73.2	94.463	5.537
.6	64.6	405.6	341.0	428.7	23.1	89	290	35.4	107.3	71.9	95.097	4.903
.6	64.8	405.6	340.8	430.6	25.0	90	305	35.5	113.1	77.6	95.353	4.647
.0	64.9	405.6	340.7	430.7	25.1	95	295	35.6	113.6	78.0	95.467	4.533
.0	64.9	405.3	340.4	430.1	24.8	94	305	35.3	112.1	76.8	94.867	5.133
.0	65.0	405.5	340.5	428.0	22.5	94	298	35.5	106.6	71.1	96.650	3.350
.7	65.1	405.0	339.9	430.9	25.9	94	306	35.3	115.9	80.6	95.673	4.327
.7	65.1	405.4	340.3	428.3	22.9	96	307	37.3	109.4	72.1	96.438	3.562
.3	65.1	405.1	340.0	430.1	25.0	97	307	35.4	113.5	78.1	93.884	4.116
											94.929	5.071

TABLE 4.—*Results of evaporative test on boilers of U. S. S. Swatara, with circulating plates in place (repetition of test of February 9), navy-yard, Portsmouth, N. H., February 16, 1888.*

Duration of experiment.......hours..	10
Water fed to boiler.......cubic feet..	1,247.02
Water fed to boiler..........pounds..	77,767.41
Coal consumed ....do ...	11,850
Refuse from coal in ashes, etc...do....	1,557
Combustible consumed.........do....	10,293
Refuse from coal...........per cent..	13.14
Temperature, Fahrenheit of—	
External air.............degrees..	11.5
Fire-room ....do....	70.30
Water in tank No. 1........ do....	53.37
Water in tank No. 2........do....	52.89
Steam in main steam-pipe...do....	300.8
Products of combustion in uptake, degrees	
Barometer, in inches of mercury......	30.31
Air-pressure in—	
Conduit, in inches of water	4.76
Ash-pit, in inches of water........	4.01
Furnace-door frame, in inches of water	3.61
Furnace, in inches of water	3.18
Uptake, in inches of water.........	.1
Revolutions of blowing engines per minute	584.8
Coal consumed per hour.... pounds..	1,185
Coal consumed per square foot of grate per hour................. pounds..	38.03
Combustible consumed per square foot of grate per hour.......... pounds..	33.03
Apparent evaporation, per tank measurement, from 53.13° F. and under observed pressure, per pound of coal consumed.............	6.563
Apparent evaporation, under same conditions as above, per square foot of grate per hour....	249.574
Equivalent apparent evaporation, from 212° F. and under atmospheric pressure, per pound of coal consumed ...	7.871
Equivalent apparent evaporation, from 212° F. and under atmospheric pressure, per pound of combustible consumed	
Actual equivalent evaporation, from 212° F. and under atmospheric pressure, per pound of coal consumed, being apparent evaporation less the water carried over by priming, as shown by calorimeter measurements.	9.060
Actual equivalent evaporation, from 212° F. and under atmospheric pressure, per pound of combustible consumed, being apparent evaporation less the water carried over by priming, as shown by calorimeter measurements......	7.471
Equivalent evaporation, from 212° F. and under atmospheric pressure, per pound of combustible consumed, had all the heat carried over by priming been utilized in vaporizing water....	8.601
	8.739

TABLE 5.—*Calorimeter measurement, evaporative test U. S. S. Swatara, with circulating plates removed, navy-yard, Portsmouth, N. H., February 10, 1888.*

No. of test.	Time of beginning test.	Steam pressure during test.	Weight in pounds of— Empty barrel.	Barrel and water.	Water (W).	Barrel, water, and condensed steam.	Condensed steam (w).	Temperature of— Air at calorimeter.	Steam in main steam-pipe.	Water, initial (t).	Water, final (tt').	t—tt'.	Percentage of— Saturated steam 100 Q.	Moisture 100 (1—Q).
	A. M.													
1	8.40	78	64.6	405.6	341.0	428.0	22.4	82	288	35.4	104.3	68.9	93.334	6.666
2	9.47	80	65.0	405.5	340.5	428.5	23.0	85	295	36.5	107.0	67.5	92.656	7.344
3	10.42	79	65.0	407.5	342.5	431.8	24.3	88	296	35.6	111.4	75.8	96.306	3.694
4	11.43	77	65.2	405.7	340.5	430.1	24.4	91	300	36.0	110.6	74.6	93.191	6.809
	P. M.													
5	12.41	73.8	65.2	405.6	340.4	430.8	25.2	93	310	35.7	113.8	78.1	95.212	4.788
6	1.41	75.5	65.1	405.6	340.5	430.2	24.6	92	315	35.4	111.6	76.2	94.877	5.123
7	2.30	76	65.5	405.0	339.5	430.3	25.3	93	302	33.4	113.0	79.6	96.547	3.453
8	3.30	76	65.6	405.0	339.4	429.6	24.6	92	309	35.9	114.0	78.1	97.715	2.285
9	4.30	77	65.5	405.0	339.5	426.4	21.4	92	305	35.7	104.1	68.4	97.428	2.572
10	5.30	76	65.3	405.2	339.9	428.5	23.3	89	303	35.5	109.0	63.5	96.554	3.446
11	6.22	76	65.4	405.5	340.1	428.3	22.8	88	297	36.7	109.4	72.7	97.976	2.024
12	7.20	76	65.4	405.5	340.1	429.6	24.1	87	305	35.5	111.4	75.9	96.699	3.301
	Averages												95.708	4.292

TABLE 6.—*Results of evaporative test on boiler of U. S. S. Swatara, with circulating plates removed, navy-yard, Portsmouth, N. H. February 10, 1888.*

Duration of experiment in hours	12
Water fed to boiler........cubic feet..	1,128.19
Water fed to boiler..........pounds..	70,378.30
Coal consumed.................do ...	12,300
Refuse from coal in ashes, etc..do....	1,545
Combustible consumed........do....	10,755
Refuse from coal...........per cent..	12.56
Temperature, Fahrenheit of—	
External air.............degrees..	8.08
Fire-room.................. do....	76.75
Water in tank No. 1........do....	46.06
Water in tank No. 2........do....	46.06
Steam in main steam-pipe..do....	304.59
Products of combustion in uptake...............degrees..	685.83
Barometer, in inches of mercury.....	30.33
Air-pressure in conduit, in inches of water	3.48
Air-pressure in ash-pit, in inches of water	2.34
Air-pressure in furnace-door frame, in inches of water	2.13
Air-pressure in furnace, in inches of water	1.75
Air-pressure in uptake, in inches of water	.07
Revolutions of blowing engines per minute	476.6
Coal consumed per hour.....pounds..	1,025
Coal consumed per square foot grate, per hour....................pounds..	32.89
Combustible consumed per square foot grate, per hour...........pounds...	28.76

Apparent evaporation per tank measurement, from 46.06° F. and under observed pressure, per pound of coal consumed	5.722
Apparent evaporation under same conditions as above, per square foot of grate per hour	188.217
Equivalent apparent evaporation from 212° F. and under atmospheric pressure, per pound of coal consumed..	6.902
Equivalent apparent evaporation from 212° F. and under atmospheric pressure, per pound of combustible consumed	7.894
Actual equivalent evaporation from 212° F. and under atmospheric pressure, per pound of coal consumed, being apparent evaporation less the water carried over by priming, as shown by calorimeter measurements.	6.606
Actual equivalent evaporation from 212° F. and under atmospheric pressure, per pound of combustible consumed, being apparent evaporation, less water carried over by priming, as shown by calorimeter measurements	7.555
Equivalent evaporation, from 212° F. and under atmospheric pressure, per pound of combustible consumed, had all the heat carried over by priming been utilized in vaporizing water...	9.6818

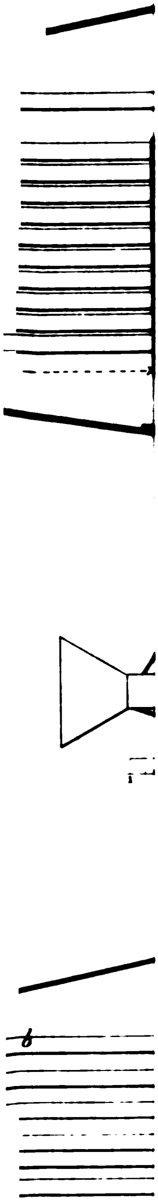
ized oil.

The drawing, Plate 7, shows the general arrangement of these parts w
tudinal section of the boiler.

The atomizer, which is of peculiar construction, is shown on Plate 8.
of a hollow globular casting 5 inches in diameter and divided into two
curved diaphragm. Through a nozzle on one side passes a pipe 1¼ inches
which extends through the diaphragm and then narrows to a one-eighth
ing. In the interior of this pipe and having the same axis is a second
eighths inch in diameter and narrowing to a one-sixteenth inch opening
posite the opening of the larger pipe. The superheated steam enters t
part from below and passes through a number of small holes in the larg
jackets the smaller pipe for a distance of 10 inches. The oil is supplied t
inside smaller pipe, being heated by the jacket, and passes in a jet thron
sixteenth inch opening, and then with the superheated steam passes t
one-eighth inch opening in the end of the larger pipe. From the globul
atomized oil and superheated steam are conducted a distance of 20 inches
inch and a quarter pipe, and then upwards to the post of the furnace door,
to the burners.

At the bend the hot-air pipe is attached, the heated air being delivere
one-eighth inch pipe extending upward to the hollow door-post. The do
arranged with a packed joint that the door can be opened and closed read
deranging the oil apparatus.

The oil pump is conveniently located within the cab at one side, and arr
a safety-valve and branch in its delivery pipe, so that when the oil press


b

o oil

the purpose of having regulating valves at hand, and then back to the coils, from which they lead directly to the atomizer.

The burners are placed on the lining plate of the furnace door. The burners proper are one hundred and twenty-four in number and are in the form of hollow frustrums of cones three-quarters inch at base and one-quarter inch at the point with one-eighth inch openings, and projecting 1¼ inches from the face of a flat casting. A second flat casting is faced and secured to the first one, and between the two is cut a spiral groove in which the pipe from the door post, supplying the atomized oil, is placed. Drilled into this pipe opposite each of the hollow conical projections are four 1.32-inch holes, and the pipe itself terminates near the middle of the casting with a screw plug which can be removed for blowing through.

The air supply pipes have bell-mouth openings, pass under the grates on both sides, thence up into the fire-box, and entirely around and at a short distance in front of the burners. They are perforated on the side toward the flame. It is designed that these shall catch the air and force it up to the flame by the forward motion of the locomotive. A damper in the door performs the same office when the engine is backing.

All the pipes through which the oil, either in the liquid or atomized form, passes, as well as that for superheated steam, are of copper or of a composition of 90 per cent. of copper, and it is the use of this material, it is claimed, which prevents the deposit of solid carbon and consequent choking.

The boiler is of the usual locomotive type, and its principal proportions are as follows, viz:

Grate surface ....square feet..	11.33
Heating surface:	
Fire-box ....do....	72.88
Tubes ....do....	736.70
Front head ....do....	6.24
Total ....do....	815.82
Ratio of grate to heating surface	1 to 72
Area of opening through tubes ....square feet..	2.92
Ratio of opening to grate surface	1 to 3.88

The water used was taken from the city hydrant and was extremely muddy, so that the boiler water-legs, which were clean at the start, were filled from 8 to 10 inches in depth with hard mud at the end of the trial.

THE TRIAL.

For the purpose of the trial, the locomotive was taken to the yard of Messrs. J. P. Agnew & Co., in Alexandria, Va., and a box-car placed on a siding to serve as a platform for the measuring tanks and to furnish a convenient place within for making the calorimetric tests.

Two large casks were used for measuring tanks and their capacities accurately determined by weighing. The casks were placed on the roof of the box-car and pipes from each led to the engine water-tank.

The steam was blown off at the safety-valve at the pressures shown in the table on page 69, and the steam for the calorimeter was taken from the boiler dome directly below and as near as possible to the safety-valve, the mouth of the pipe being directed against the current of the flow. This pipe led inside the box-car where the calorimetric tests were made.

The water was fed to the boiler by the injector, but all the overflow was caught and returned to the tank. Care was taken that there were no leaks or loss from any cause.

All preliminaries having been arranged, the trial was begun on the morning of the 3d instant. As steam was required for the atomizer, it was necessary to start fires in the usual way with wood and coal.

Fire was started at 8.20 a. m., 247 pounds of pine and 756 pounds of anthracite coal (egg size) being used for this purpose. Steam formed at 10.10 a. m., and at 10.52 a. m., there being 75 pounds pressure indicated by the gauge, the dampers were tightly closed, the surface of the coal in the fire-box covered to the depth of 2 inches with refuse and earth, and the oil fire started. It was believed that the closing of the dampers and covering of the coal would wholly eliminate any effect the starting fire might otherwise have, but to be doubly sure the oil fire was continued at full force

until 11.30 a. m., three hours and ten minutes from time of starting, before the trial proper was begun. At that time the water level in the boiler was as near as possible midway between two and three gauge cocks (there was no glass gauge), the level of water and oil in the tanks of the tender was marked, and the taking of data, which were recorded half hourly, commenced. The trial lasted for six hours, or until 5.30 p. m., at which time the level of the water in the boiler and in the tank was the same as at starting.

Three barrels of oil, all that was at hand, had been weighed and supplied to the tank and four inches in depth additional used from the tank. The area of the tank was then carefully measured, and it was found that this additional amount was 45.6 gallons, which at 6.85 pounds per gallon was 312 pounds.

The three barrels weighed 1,015 pounds net, or there was used a total of 1,327 pounds of oil.

The capacities of the water tanks were, No. 1, 786 pounds of water; No. 2, 718 pounds of water.

The observed data with totals and averages are given in the following table:

Hour.	Pressures per gauge.			Temperatures.				Barometer.	Times at which tanks were emptied.		Pounds of oil used.
	Steam.	Oil in pipe.	Hot air in pipe.	Atmosphere.	Feed water.	Steam (thermometric).	Uptake.		No. 1.	No. 2.	
M. 12.00	118	150	65	69	61	340	540	30.56	12.00	12.07	....
P. M. 12.30	108	145	63	67	64	337	550	30.56	12.35	12.42	....
1.00	105	142	64	67	67	335	550	30.56	12.55	1.00	....
1.30	102	140	62	68	67	335	550	30.56	{ 1.18 1.30	} 1.23	339
2.00	101	136	55	68	68	332	552	30.57	1.55	1.35	....
2.30	105	140	54	70	68	332	552	30.57	2.15	{ 2.04 2.20	....
3.00	108	125	53	70	68	333	552	30.57	2.40	2.47	330
3.30	107	120	53	71	68	333	565	30.57	3.20	3.28	....
4.00	106	105	53	69	69	332	565	30.59	3.45	3.50	346
4.30	112	100	57	70	69	340	565	30.59	4.23	4.28	....
5.00	112	93	58	70	69	335	565	30.59	4.58	5.08	....
5.30	108	120	55	69	69	335	575	30.59	*5.28	5.28	†312
6 hours	1,290	1,516	692	828	807	4,019	6,681	366.88	‡13½	‡13	1,327
Averages	107.5	126.3	57.7	69	67.25	334.1	556.75	30.57	§10,611	§9,334	....

* Half barrel. † 45.6 gallons measured. ‡ Tanks. § Total water, 19,945 pounds.

The apparent evaporation of water per pound of oil from a temperature of 67.25° and under an absolute pressure of 122.5 pounds per square inch, then was:

$$19{,}945 \div 1{,}327 = 15.03 \text{ pounds,}$$

and for the equivalent evaporation from and at a temperature of 212° we have:

Absolute pressure (p)	=	122.5
Total heat of steam at this pressure (H)	=	1,186.4361
Temperature of feed-water (t)	=	67.25°
Total heat of water at temperature t, (h)	=	35.2616
Units of heat required to vaporize 1 pound of water from temperature t, and under an absolute pressure p, (H — h)	=	1,151.1745
Units of heat required to vaporize 1 pound of water from and at a temperature of 212°		965.7

Then $15.03 \times 1151.1745 \div 965.7 = 17.916$ pounds, which would be the true equivalent evaporation from and at 212° had the water been all vaporized, or had the product been dry saturated steam.

During the trial five reliable calorimetric measurements of the quality of the steam were made and the observed data and computed results, calculated by the formula

$$Q=\frac{1}{l}\left[\frac{W}{w}(h'-h)-(T-h')\right]$$

are given in the following table:

No. of test.	Average steam pressure per gauge.	Weights. W.	Weights. w.	Temperatures. t.	Temperatures. t'.	h.	h'.	T.	l.	Proportion of dry steam. Q.
1	109.3	304	11	74.7	110.2	42.7193	78.2972	315.6092	871.1623	0.8562
2	101.0	300	15	60.7	111.1	28.7067	79.2002	310.2463	874.9403	0.8901
3	107.5	300	13	63.4	110.7	51.4085	78.7989	314.4726	871.9635	0.98[illegible]9
4	108.5	300	14	59.7	111.3	27.7061	79.4009	315.1081	871.5156	1.0066
5	111.0	300	14	62.9	110.6	30.9082	78.6985	316.6632	870.4192	0.9031
Proportion of dry steam .... 92.7 per cent.								Total		4.6339
Proportion of moisture (1,000—0.927) .... 7.3 per cent.								Average		0.927

The averages of these results give 92.7 per cent. of dry steam and 7.3 per cent. of moisture which passed off with the steam.

To determine the correct potential evaporation and the actual heat units realized from the combustion of the fuel, as measured by the steam produced, we have the following data and computations.

Units of heat required to vaporize 1 pound of water from temperature 67.25° and under absolute pressure 122.5 =	1151.1745
Units of heat required to raise the temperature of 1 pound of water from 67.25° to 342.61°, the temperature due to the absolute pressure 122.5, 314.4726—35.2616 =	279.2110
Total pounds of water fed to boiler	19,945
Pounds of water vaporized, 19945 × .927	18,489
Pounds of water raised in temperature, 19945 × .073 =	1,456
Units of heat required to vaporize the water = 18489 × 1151.1745 =	21284065.33
Units of heat required to raise the temperature of the water = 1456 × 279.211 =	406531.22
Total units of heat derived from the fuel, as measured by the steam discharged	21690596.55
Units of heat per pound of oil, 21690596.55 ÷ 1327 =	16345.59
Number of pounds of water of temperatu 67.2 5° that would have been vaporized under an absolute pressure f 122.5 pounds per pound of oil, or potential evaporation, 16345.59 ÷ 1151.1745 =	14.199
Equivalent potential evaporation from and at 212°, 16345.59 ÷ 965.7 =	16.926

The oil fire was practically noiseless and smokeless, and there was no evidence, in the way of leaks or odor, to indicate that petroleum was burning.

It is probable that the high temperature and quantity of the steam supplied to the atomizer was more than sufficient to wholly volatilize all the oil, and that the heated air later supplied in the pipe was also of sufficiently high temperature to prevent any condensation, so that the fire was really a gas flame. Just what these temperatures were the board had no means of accurately determining, but the superheated steam pipe, 30 inches distant from its passage through the boiler front, was sufficiently hot to quickly melt and vaporize zinc, while at the atomizer it readily melted lead; hence the temperature of the steam must have been near 800° Fahrenheit while the temperature of the heated air, judging by the touch, must have been above 200° Fahrenheit within the pipe.

The quantity of air and steam required for the atomizer could not have been large, for the former was all delivered through a one-sixteenth inch orifice under a pressure of 57.7 pounds, and a moderate motion of the air-pump supplied it, while the latter, together with the entire oil supply for the fire, was delivered through a one-eighth inch orifice, the pressure being 107.5 pounds, and the difference of pressure on the two sides causing the flow being necessarily less than this.

A sample of oil taken from the tank during the progress of the the trial was, by the courtesy of Surgeon-General J. M. Browne, U. S. N., Chief of the Bureau of Medicine

and Surgery, submitted to the chemist of the Naval Museum of Hygiene for analysis, with the following result:

C=84.08	Specific gravity, 0.822.
H=14.40	Flashing point, 64° Fahrenheit.
O= 1.52	
N=Trace.	
100.00	

With the chemical composition of the fuel and the following formula, based on the experimental determinations of Messrs. Favre and Silbermann, we are able to compute the number of heat units that its complete and perfect combustion will produce:

$$h = 14500\left[C + 4.28\left(H - \frac{O}{8}\right)\right]$$

This gives

$$h = 21010.326$$

The equivalent evaporation from and at 212° is

$$E = \frac{h}{965.7}$$

which gives

$$E = 21.756 = \text{pounds of water.}$$

Whence it appears that there was realized with petroleum in the device tested 77.8 per cent. of the total heat of evaporation of which it was theoretically capable, which is a much larger proportion than is possible under any conditions of actual working practice with the best quality of coal.

The facility of handling petroleum and manipulating the fires is very decidedly in its favor, and a much smaller force would be required for that purpose than with coal.

The trial was not of sufficient duration to absolutely demonstrate the permanent efficiency of the device for burning petroleum, but an examination after its conclusion showed no evidence of any deposit of carbon in the pipes or burners, and certainly the heat and evaporative efficiency were as great at the conclusion as at the beginning.

The representative of the company informed us that the device experimented with had been in use for three years, that it had not been cleaned, and that there had never been any evidence of carbon deposit.

The question of safety in stowing and handling has not been decided, but in the opinion of the Board this could be satisfactorily provided for by the use of closed tanks, water-jacketed, with vent pipes overboard, and by careful workmanship in connecting pipes, fittings, and valves.

We are of the opinion that the system could be advantageously adopted on board torpedo-boats and coast-defense vessels, if safety in stowage and handling can be clearly arranged, and think the device of the Petroleum Fuel and Motor Company, of Washington, D. C., worthy of a trial, particularly as it can be applied without interference with the coal-burning arrangements.

Very respectfully, your obedient servants,

A. S. GREENE,
Chief Engineer, U. S. N.
C. W. RAE,
Passed Assistant Engineer, U. S. N.
R. S. GRIFFIN,
Assistant Engineer, U. S. N.

Engineer-in-Chief GEORGE W. MELVILLE, U. S. N.,
Chief of the Bureau of Steam Engineering,
Navy Department, Washington, D. C.

Tests of oscillating engines, blower, and centrifugal pump for commandant's barge, made by Passed Assistant Engineer J. J. Barry, U. S. N., at the New York navy-yard, in June and July, 1883.

The two oscillating engines tested were practically the same as shown on Plate 9, which gives the modified frame, adopted after the tests, and shows a spring to hold the pins up against the trunnion bearings, instead of two wedges used during the tests. Both modifications were made as a result of the tests. In the engine shown in the plate, the two parts of the frame are made from the same pattern, are each symmetrical as regards their vertical center line, and differ from each other only in the various holes drilled in them. Both main bearings are alike, and the crank-shaft is made to suit. With this arrangement the engine can be put on either side of a blower and run in either direction.

The trunnion bearings are slipped in place from the inside of the frame before the engine is put together. A steel pin bears against each trunnion bearing, both pins being kept up to place by a single-leaf steel spring. This spring is adjusted by lock-nuts on a stud which projects from a saddle resting on the two tie-rods. The dimensions of the spring shown in the plate are trial dimensions, and will be altered if experience makes it necessary or advisable.

Blower tests.—The blower, to which one of the oscillating engines was directly connected, was a Sturtevant "Monogram" No. 2, with an outlet 7½ inches in diameter. The blower and its engine were both securely bolted to a temporary bed-plate. During the tests of the blower no heating of the engine journals was noticeable, and the engine worked very well, except that during the six hours' run at the greatest speed possible with a steam pressure of 100 pounds per square inch, a slight leak developed around the valve-face.

The record of the tests at various speeds is given in Table I, and of the six hours' test in Table II.

Pump tests.—The centrifugal pump, to which the other oscillating engine was directly connected, was a No. 1¼ Morris Machine Company's pump, with a discharge opening 1¼ inches in diameter. The engine and pump were securely fastened to a temporary bed-plate, which was bolted to two angle-iron supports. The latter and suction end of the pump were secured to a tank, which was placed on a platform scale for convenience in measuring the actual quantity of water put into and discharged from the tank. Tests were made at various speeds, the record of which is given in Table III. The water in the tank was on a level with the discharge opening of the pump.

With a mean steam pressure of 99.8 pounds per square inch and a mean number of revolutions of 322.8 per minute, the maximum quantity of water discharged by the pump was 113.73 gallons per minute.

The engine and pump were finally run for three hours at the greatest speed possible with a steam pressure of 100 pounds per square inch, pumping water out of and discharging it into the tank for the purpose of testing the engine. No defects were noticed, the engine working very well and all journals running cool.

The steam for all tests was taken from a boiler whose safety-valve was set at a little over 100 pounds. The steam pressures recorded in the tables were taken from a gauge 4 inches from the engines.

Table I.—*Test of engine and blower for commandant's barge at various speeds.*

Time.	Pressure of steam.	Air pressure in inches of water.	Revolutions of engine per minute.	Reading of anemometer.	Velocity of flow in feet per minute.
11.00.....	00	.00	0,000	36,439	0,000
11.05.....	25	.70	1,220	39,849	3,410
11.10.....	25	.70	1,156	43,448	3,599
11.15.....	26	.70	1,228	47,132	3,684
11.20.....	26	.70	1,241	50,743	3,611
11.25.....	26	.70	1,215	54,295	3,552
11.30.....	26	.70	1,220	57,902	3,607
11.35.....	26	.70	1,264	61,579	3,677
11.40.....	25.5	.70	1,198	65,175	3,596
11.45.....	26	.70	1,262	68,983	3,808
11.50.....	25	.70	1,313	72,642	3,659
11.55.....	26	.70	1,305	76,114	3,472
12.00.....	26	.70	1,303	79,837	3,723
Means ...	25.7	.70	1,243.75	....	3,646.5

Correction for anemometer = 30 per minute; 30 per minute = 360 is included in deducing mean reading of anemometer. Number of cubic feet per minute at mean velocity, 974.5770.

Time.	Pressure of steam.	Air pressure in inches of water.	Revolutions of engine per minute.	Reading of anemometer.	Velocity of flow in feet per minute.
1.35.......	30	.80	1,399	83,819	3,982
1.40.......	30	.80	1,334	87,439	3,620
1.45.......	30	.80	1,383	91,008	3,569
1.50.......	28	.75	1,348	94,559	3,551
1.55.......	30.5	.80	1,408	98,097	3,538
2.00.......	31	.80	1,475	101,678	3,581
2.05.......	31	.80	1,454	105,134	3,456
2.10.......	30.5	.80	1,463	108,560	3,426
2.15.......	30.5	.80	1,460	112,427	3,867
2.20.......	31	.80	1,488	116,457	4,030
2.25.......	30.5	.80	1,446	120,126	3,669
2.30.......	30	.80	1,430	123,836	3,710
2.35.......	29.5	.80	1,405	127,373	3,537
Means	31.9	.796	1,422.5	....	3,684.3

Correction for anemometer = 30 per minute; 30 per minute = 390 is included in deducing mean reading of anemometer. Number of cubic feet per minute at mean velocity, 984.6803.

Time.	Pressure of steam.	Air pressure in inches of water.	Revolutions of engine per minute.	Reading of anemometer.	Velocity of flow in feet per minute.
2.35.......	00	.00	0,000	127,373	0,000
2.40.......	35	.85	1,542	131,201	3,828
2.45.......	35	.85	1,508	135,165	3,964
2.50.......	35	.85	1,505	138,970	3,805
2.55.......	35	.85	1,570	142,774	3,804
3.00.......	36	.90	1,620	146,859	4,085
3.05.......	36	.90	1,616	140,802	3,943
3.10.......	35.5	.90	1,585	154,713	3,911
3.15.......	36	.95	1,633	158,686	3,973
3.20.......	35	.95	1,604	162,632	3,946
3.25.......	35.5	.95	1,623	166,523	3,891
3.30.......	34.5	.90	1,577	170,545	4,022
3.35.......	35.5	.95	1,610	174,562	4,017
Means ...	35.33	.90	1,582.75	....	3,962.4

Correction for anemometer = 30 per minute; 30 per minute = 360 is included in deducing mean reading of anemometer. Number of cubic feet per minute at mean velocity, 1,052.0613.

Time.	Pressure of steam.	Air pressure in inches of water.	Revolutions of engine per minute.	Reading of anemometer.	Velocity of flow in feet per minute.
10.20.......	40	.75	1,415	203,786	3,535
10.25.......	40	.80	1,654	207,430	3,644
10.30.......	40	.90	1,570	211,303	3,873
10.35.......	40	.85	1,540	215,255	3,952
10.40.......	40.5	.90	1,585	219,279	4,024
10.45.......	40.5	.95	1,600	223,422	4,143
10.50	40.5	1.00	1,600	227,311	3,859
10.55.......	40	1.00	1,580	231,180	3,869
11.00.......	40.5	1.00	1,600	235,023	3,843
11.05.......	40	1.00	1,593	239,643	4,620
11.10.......	40	1.00	1,580	243,591	3,948
11.15.......	40	1.00	1,600	247,488	3,897
Means	40.1	.929	1,576.41	....	3,966.4

Correction for anemometer = 30 per minute; 30 per minute = 360 is included in deducing mean reading of anemometer. Number of cubic feet per minute at mean velocity, 1,060.0755.

TABLE I.—*Test of engine and blower for commandant's barge, etc.*—**Continued.**

Time.	Pressure of steam.	Air pressure in inches of water.	Revolutions of engine per minute.	Reading of anemometer.	Velocity of flow in feet per minute.
11.15.....	00	0.00	0,000	247,488	0,000
11.20.....	45	1.10	1,675	251,691	4,203
11.25.....	45	1.10	1,640	255,876	4,185
11.30.....	45	1.10	1,683	260,055	4,179
11.35.....	45.5	1.10	1,742	264,194	4,139
11.40.....	45	1.10	1,676	268,363	4,169
11.45	45	1.15	1,710	272,589	4,226
11.50	45	1.10	1,675	273,750	4,161
11.55.....	45.5	1.15	1,717	280,985	4,235
12.00.....	45.5	1.15	1,743	285,300	4,315
12.05.....	45	1.10	1,680	289,521	4,221
12.10.....	45.5	1.15	1,733	293,618	4,097
12.15....	45	1.10	1,686	297,836	4,218
Means.	45.16	1.11	1,696.6	....	4,225.6

Correction for anemometer = 30 per minute; 30 per minute = 360 is included in deducing mean reading of anemometer. Number of cubic feet per minute at mean velocity, 1,129.3503.

Time.	Pressure of steam.	Air pressure in inches of water.	Revolutions of engine per minute.	Reading of anemometer.	Velocity of flow in feet per minute.
2.05.......	50	1.10	1,724	302,002	4,106
2.10.......	50	1.10	1,705	306,182	4,180
2.15.......	50.5	1.20	1,753	310,653	4,471
2.20.......	50	1.20	1,740	315,063	4,410
2.25.......	49.7	1.15	1,700	319,270	4,207
2.30.......	50	1.15	1,710	323,502	4,232
2.35.......	50.5	1.15	1,743	327,751	4,249
2.40.......	50.5	1.20	1,773	332,079	4,328
2.45.......	50.5	1.25	1,782	336,544	4,465
2.50.......	51	1.25	1,790	340,952	4,408
2.55.......	51	1.25	1,801	345,488	4,536
3.00.......	51	1.30	1,805	349,839	4,351
Means....	50.39	1.19	1,752.16	....	4,363.6

Correction for anemometer = 30 per minute; 30 per minute = 360 is included in deducing mean reading of anemometer. Number of cubic feet per minute at mean velocity, 1,166.2327.

Time.	Pressure of steam.	Air pressure in inches of water.	Revolutions of engine per minute.	Reading of anemometer.	Velocity of flow in feet per minute.
3.00.......	00	0.00	0,000	349,839	0,000
3.05.......	55	1.40	1,870	354,360	4,521
3.10	55	1.35	1,844	358,929	4,569
3.15.......	56	1.40	1,905	363,521	4,592
3.20.......	56	1.40	1,885	368,231	4,710
3.25.......	56	1.40	1,890	372,905	4,674
3.30	56	1.45	1,900	377,462	4,557
3.35.......	55	1.40	1,880	382,126	4,664
3.40.......	56	1.45	1,910	386,810	4,684
3.45.......	56	1.45	1,923	391,464	4,654
3.50.......	56	1.45	1,927	396,119	4,655
3.55.......	56	1.45	1,917	400,867	4,748
4.00.......	56	1.45	1,910	405,539	4,672
Means. .	55.75	1.42	1,895.91	....	4,671.7

Correction for anemometer = 30 per minute; 30 per minute = 360 is included in deducing mean reading of anemometer. Number of cubic feet per minute at mean velocity, 1,248.5767.

Time.	Pressure of steam.	Air pressure in inches of water.	Revolutions of engine per minute.	Reading of anemometer.	Velocity of flow in feet per minute.
10.00.......	00	0.00	0.000	405,539	0,000
10.05.......	60	1.45	1,854	410,277	4,738
10.10.......	60	1.50	1,920	415,033	4,756
10.15.......	60	1.50	1,908	419,750	4,717
10.20.......	60	1.50	1,929	424,501	4,751
10.25.......	60	1.50	1,935	429,208	4,707
10.30.......	61	1.55	1,942	434,038	4,810
10.35.......	60	1.50	1,920	438,860	4,822
10.40.......	59.5	1.45	1,874	443,404	4,544
10.45.......	61	1.50	1,925	448,175	4,771
10.50.......	61	1.50	1,930	452,918	4,743
10.55	61	1.50	1,920	457,647	4,729
Means....	60.32	1.49	1,914.3	....	4,767

Correction for anemometer = 30 per minute; 30 per minute = 330 is included in deducing mean reading of anemometer. Number of cubic feet per minute at mean velocity, 1,274.0169.

TABLE I.—*Test of engine and blower for commandant's barge, etc.*—**Continued.**

Time.	Pressure of steam.	Air pressure in inches of water.	Revolutions of engine per minute.	Reading of anemometer.	Velocity of flow in feet per minute.
11.00	60	0.00	0,000	457,047	0,000
10.05	66	1.60	2,070	462,444	4,797
11.10	65	1.55	1,960	467,283	4,839
11.15	65	1.55	1,950	472,160	4,877
11.20	66	1.59	1,985	477,187	5,027
11.25	66	1.60	2,000	482,175	4,988
11.30	66	1.60	1,990	487,222	5,047
11.35	66	1.63	1,970	492,739	5,517
11.40	66	1.60	1,985	498,397	5,658
11.45	66	1.60	1,955	503,923	5,526
11.50	66	1.60	1,969	509,574	5,651
11.55	66	1.60	1,975	515,109	5,535
12.00	66	1.60	1,946	520,649	5,540
Means	65.83	1.59	1,981.3	....	5,280.1

Correction for anemometer = 30 per minute; 30 per minute = 360 is included in deducing mean reading of anemometer. Number of cubic feet per minute at mean velocity, 1,411.1153.

TABLE II.—*Test of engine and blower for commandant's barge at maximum speed for six hours.*

Time.	Pressure of steam.	Air pressure in inches of water.	Revolutions of engine per minute.	Reading of anemometer.	Velocity of flow in feet per minute.	Time.	Pressure of steam.	Air pressure in inches of water.	Revolutions of engine per minute.	Reading of anemometer.	Velocity of flow in feet per minute.
10.00	60.0	0.00	0,000	520,619	0,000	1.20	65.0	1.45	1,865	629,278	5,287
10.10	63.0	1.50	1,850	525,974	5,325	1.30	65.0	1.45	1,892	634,955	5,677
10.20	64.0	1.50	1,960	531,228	5,254	1.40	65.0	1.40	1,893	640,533	5,578
10.30	65.0	1.50	1,911	536,660	5,432	1.50	65.5	1.45	1,920	646,352	5,819
10.40	65.0	1.50	1,907	541,200	4,540	2.00	65.0	1.40	1,900	652,003	5,651
10.50	65.0	1.70	1,907	546,763	5,503	2.10	65.0	1.40	1,903	657,599	5,596
11.00	65.0	1.50	1,913	552,158	5,455	2.20	64.5	1.45	1,900	662,912	5,313
11.10	65.0	1.50	1,918	557,744	5,586	2.30	65.0	1.45	1,920	668,416	5,504
11.20	65.0	1.50	1,882	563,222	5,478	2.40	65.0	1.50	1,930	673,970	5,554
11.30	65.5	1.60	1,947	568,845	5,613	2.50	65.0	1.45	1,909	679,449	5,479
11.40	65.0	1.59	1,960	574,227	5,482	3.00	66.0	1.50	1,954	685,164	5,715
11.50	65.5	1.60	1,948	579,965	5,638	3.10	66.0	1.50	1,965	691,043	5,879
12.00	65.5	1.60	1,961	585,862	5,897	3.20	65.0	1.50	1,945	696,840	5,797
12.10	65.0	1.50	1,913	591,337	5,475	3.30	66.0	1.50	1,900	702,498	5,658
12.20	65.0	1.55	1,951	596,872	5,535	3.40	66.0	1.50	1,953	708,214	5,716
12.30	65.0	1.50	1,910	602,410	5,538	3.50	66.0	1.50	1,960	713,872	5,658
12.40	65.0	1.50	1,957	606,948	4,523	4.00	66.0	1.50	1,964	719,423	5,551
12.50	65.0	1.50	1,9[illegible]9	612,4[illegible]3	5,465						
1.00	65.0	1.50	1,960	618,096	5,633	Means	65.15	1.49	1,920		5,551.5
1.10	65.0	1.50	1,957	623,941	5,935						

Correction for anemometer = 30 per minute; 30×36 = 1,080 is included in deducing mean reading of anemometer. Number of cubic feet per minute at mean velocity, 1,483.7154.

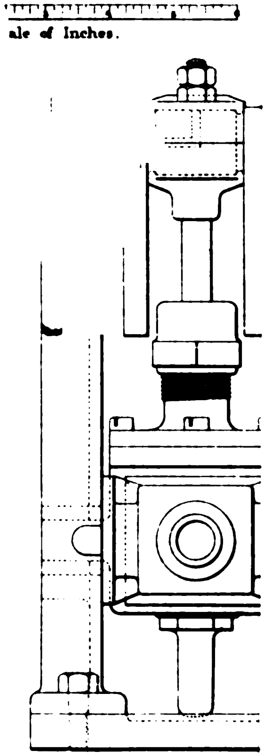

ale of Inches.

TABLE III.—*Test of engine and centrifugal pump for commandant's barge at various speeds.*

Number.	Pressure of steam.	Revolutions of engine per minute.	Gallons water discharged per minute.	Height of discharge in feet.	Pressure in pounds at discharge of pump.
1......	50	173	59.10	1.16	.500
2......	55	228	75.00	1.16	.750
3......	60	240	75.00	1.16	.875
4......	65	247	76.80	1.16	.875
5......	70	256	85.92	1.16	.875
6......	75	265	88.32	1.16	.875
7......	81	274	96.72	1.16	1.000
8......	85	285	98.16	1.16	1.000
9......	87	295	100.80	1.16	1.000
10......	90	300	102.00	1.16	1.125
11......	95	306	106.92	1.16	1.250
12......	98	310	109.20	1.16	1.250
13......	99	316	112.20	1.16	1.500
14......	100	318	112.80	1.16	1.500
1......	30	169	Pumping into tank.*	1.16	.250
2......	35	190		1.16	.250
3......	40	200		1.16	.250
4......	45	223		1.16	.375
5......	50	234		1.16	.500
6......	55	251		1.16	.500
7......	60	263		1.16	.500
8......	65	268		1.16	.625
9......	70	275		1.16	.625
10......	75	283		1.16	.750
11......	80	290		1.16	.750
12......	85	298		1.16	.875
13......	90	308		1.16	1.000
14......	95	313		1.16	1.250
15......	100	320		1.16	1.500
16......	100	322		1.16	1.500
17......	100	320		1.16	1.500
18......	100	320		1.16	1.500
19......	100	323		1.16	1.500
20......	100	322		1.16	1.500

Number.	Pressure of steam.	Revolutions of engine per minute.	Gallons water discharged per minute.	Height of discharge in feet.	Pressure in pounds at discharge of pump.
1......	100	330	112.98	1.16	1.5
2......	100	330	113.46	1.16	1.5
3......	100	334	114.00	1.16	1.5
4......	100	332	114.54	1.16	1.5
5......	100	333	114.60	1.16	1.5
6......	100	336	114.00	1.16	1.5
7......	100	333	114.00	1.16	1.5
8......	99	330	111.24	1.16	1.5
9......	100	334	114.00	1.16	1.5
10......	90	336	114.54	1.16	1.5
Means...	90.8	332.8	113.73	1.16	1.5
1......	40	245	13.35	5	2.500
2......	45	264	20.16	5	2.500
3......	50	272	20.40	5	2.750
4......	55	280	28.61	5	2.750
5......	56	289	28.61	5	2.750
6......	59	298	35.35	5	3.000
7......	65	300	35.47	5	3.000
8......	70	322	35.59	5	3.000
9......	75	324	37.90	5	3.125
10......	80	328	38.76	5	3.250
11......	85	338	42.57	5	3.250
12......	90	349	46.81	5	3.250
13......	95	353	64.02	5	3.250
14......	100	342	63.48	5	3.250
15......	100	345	64.42	5	3.250
16......	100	352	64.42	5	3.250

Pumping out of and discharging into tank to ascertain increase in revolutions under different pressures of steam

INDICATOR TESTS.

[Extract from the report of a board of United States Naval Engineer officers, composed of Chief Engineer David Smith and Passed Assistant Engineers W. A. Windsor and J. J. Barry, on tests of a Thompson and a Tabor indicator, made at the New York navy-yard in 1888.]

The Thompson indicator was submitted by the American Steam-gauge Company, and the Tabor indicator by the Ashcroft Manufacturing Company.

A representative of the former firm was present during the first half of the tests and two representatives of the latter were present during the greater part of the time, one remaining until the tests were completed.

Both indicators were new and of the latest improved patterns, and good samples of their respective types.

The representatives of both makers stated that these indicators were taken from stock, and that all their instruments were carefully tested under steam pressure and found to be correct before they left their works.

A horizontal pipe, 2 inches diameter and 24 inches long, fitted with suitable pipes and valves for the admission and discharge of steam and provided with three nipples, two for the attachment of indicators and one for a steam-gauge, was used in making the statical steam tests.

MANNER OF MAKING THE TESTS.

The steam-gauge having been secured in place, steam was blown through the test-pipe and indicator nipples several times to free the pipe of water and dirt.

The indicators, after being well oiled, were secured in position and steam admitted, the pressure being allowed to rise until the limit for which the springs were designed was reached, in order to bring the instruments to their working temperature.

After trying the instruments to see that their movements were free, steam was discharged from the test-pipe and the indicator cocks closed. The piston of each instrument was then pressed down slightly by hand and allowed to return to its normal position, with the friction of the moving parts opposed to the movement of the spring. When this had been done, the atmospheric line was drawn across the card. Steam was then admitted to the instruments and so regulated that the hand of the steam-gauge would rise slowly to the interval of pressure to be noted, and when it reached that point, at the word "mark," an operator stationed at each instrument drew the required line of its scale. All lines of the scales were drawn in the same manner, the top steam line of the first test of each series being extended across the card.

Before beginning the down scales, the steam was allowed to rise a pound or two above the pressure to be first noted, in order to oppose the friction of the instrument to the movement of the spring. At the end of the down scale, the steam was shut off and discharged from the pipe and the indicator cock closed before drawing the atmospheric line.

After making several scales in the manner described, the representatives of both makers expressed their dissatisfaction with the irregularities found in them, which they attributed to the defects of the steam-gauge used, rather than to any fault in their instruments. They requested that another gauge be substituted, and offered to furnish one that was known by them to be correct. The Board accepted the offer, as it had but little confidence in the accuracy of the mercury column at the yard. This column is crude in design and has been in use for many years, and the interior of the tubing is probably more or less corroded.

An indicator test-gauge with a 12-inch face was furnished by the Ashcroft Manufacturing Company, with the statement that it agreed with their mercury column, and was the one used at their works for testing indicators. This gauge was accepted by the representative of the American Steam-gauge Company, as well as by the Board, and was used in making all the scales of the 30, 40, and 60 pound springs; while a compound gauge (of the American Steam-gauge Company's make), belonging to the yard was used in making the scales of the 20-pound spring.

To determine the comparative indications of identically the same power by the two instruments, each fitted with 20 and with 40 pound springs, the following method was used:

The indicator pipe at the outer end of the machine-shop engine was fitted with a T and two right-angle branch pipes of equal diameters and lengths terminating in

nipples. To the latter, the indicators were attached, after clearing the pipes of water and dirt and lubricating the cylinders. The springs of the paper drums were adjusted to approximately the same tension. The cords around these drums were tied to each other and to a single cord connecting with the indicator motion. This arrangement gave coincident motion to both drums without sensibly affecting the lead of the cords, as the angle between the latter was small.

One operator could readily take cards from both indicators at the same time.

Ten cards having been taken from each indicator, the latter were interchanged and then ten more cards taken from each. This change was made in order to eliminate any errors due to possible differences in the bore and lead of the branch pipes.

Two sets of cards were thus taken, one with 20-pound springs in the indicators, and the other with 40. The data and computations from them are given in Table III.

RELATIVE MOVEMENTS OF PENCIL AND PISTON.

The test to determine this was made as follows:

The spring of each indicator having been removed, a micrometer gauge was fitted to the cylinder and the weight of the piston and attachments taken on the end of the micrometer screw, the zero of the wheel coinciding with that of the vernier. A line was then drawn with the pencil of the instrument and formed the first one of the scale. The micrometer screw was then turned one revolution and a second line drawn; this was repeated until the scale was complete for the movement of the piston.

A scale for each instrument, taken in the manner above described, is shown in Plate 9 and marked A.

From these scales the intervals are found to be $\frac{1}{10}$ inch for the Thompson and $\frac{1}{8}$ inch for the Tabor indicator.

As the pitch of the micrometer screw is $\frac{1}{40}$ inch, the pencil movement of the former is four times, and of the latter five times, that of its piston.

The intervals of the Tabor scale are very uniform, while those of the Thompson decrease toward the end, and more particularly at the bottom of the scale.

LINE OF MOTION OF THE PENCIL.

A test to determine the line of motion of the pencil in each instrument was made as follows:

The spring having been removed, the piston was pushed up its entire stroke, the pencil at the same time drawing a line on the card, while the paper drum was securely held by the detent attachment. Ten such lines were drawn on the card with each instrument. These cards are marked B on the plate.

The lines of the Thompson movement show a slight bending to the right at the top, and a more noticeable bending to the left at the bottom ends, while the middle portion of the lines are comparatively straight. Those taken by the Tabor instrument are nearly straight, but curve slightly, with the convexity toward the left hand.

WEIGHTS OF THE MOVING PARTS.

All moving parts of both instruments were carefully weighed and their weights in Troy grains found to be as follows:

	Thompson.	Tabor.
Weight of 20 pound spring	338	261
Weight of 40-pound spring	457	350
Weight of piston, piston-rod, and screw at upper end	414	287
Weight of pencil-bar and attachments	39	31
Weight of pencil	5	5
Weight of back link and upper screw	45	38
Total weight of moving parts (with 20-pound spring)	841	622
Total weight of moving parts, less one-half weight of springs, back link, and radius bar (9 grains), that are supported at one end	645	472

Percentage of the Thompson over the Tabor indicator in the effective weight of its moving parts, 36.5 per cent.

TEST OF STEAM-GAUGES.

At the conclusion of the foregoing tests, the steam-gauges used in the work were carefully compared with the mercury column for pressures above atmosphere; for pressures below that line, the compound gauge was compared with the mercurial vacuum test-gauge.

Table I gives the readings of the two gauges used in making the tests, compared with the reading of the mercury column taken as a standard.

The mean reading of the Ashcroft test-gauge varies from 0.45 pound above to 1.875 pounds below that of the column, and the compound gauge from 0.1375 pound above to 1 pound below. The mean variation of all the readings of the former is 0.6001 pound, and of the latter, 0.5173 pound below that of the column.

Table II gives, numerically, the means of the six readings, taken from each indicator for each interval of pressure and for each spring tested, as found by measurement from the scales. These figures will represent very accurately the tensions of the springs under the different pressures, if the gauge used is taken as the standard.

It appears from this table that all springs of both instruments are too weak, as their scale readings are too high, excepting that of the 20-pound spring below the atmospheric line, which is too low. The differences between the readings of the gauge and the spring are much greater in the Thompson than in the Tabor scales.

The difference between the readings of the "up" and "down" scales gives the retarding effect of the friction, or double the friction of the indicator and gauge. But, as the friction of the latter is small compared with that of the former, and is the same for both instruments, it can be neglected, and the differences taken as the double friction of the indicators.

Table III gives the mean pressures and indicated horse-powers found from cards which were taken in pairs simultaneously from the machine-shop engine with the two indicators, using 20 and 40 pound springs.

In the absence of a standard, it can not be determined positively which of the two instruments is the more accurate indicator of power.

INDICATOR ATTACHMENTS.

The two indicators are of the same general design, and are both fitted with pencil-stop, detent attachment to paper drum, guide-pulleys for cord, and thumb-screw for the guide-pulley arm.

The pencil-holder, pencil-bar, links, and piston-rod connections are made of tempered steel in both instruments. The essential differences are in the means employed to give rectilinear motion to the pencil, the springs, paper drums, and in the weight of moving parts.

A jointed parallel motion is used on the Thompson indicator. The Tabor instrument has a guide-pin with friction roller, on the pencil-bar, working in a fixed curved guide. By giving proper curvature to the guide, perfectly rectilinear motion of the pencil can be obtained. Tests show that the rolling friction of the guide is comparatively small.

The helices of the duplex spring used in the Tabor indicator are of the same diameter and length and have their ends secured on opposite sides of the fittings, thus giving a better and firmer support to the piston than if only one spring were used.

With the top of the paper drum closed, as in the Thompson indicator, the drum is less liable to distortion, its interior is protected from dust and dirt, and greater security given to it by the support it receives from the spool-spindle which passes through it.

Other things being equal, the smaller the weight of the moving parts of an indicator consistent with strength, the greater will be the accuracy and reliability of the instrument as a measure of power at different speeds, as the error due to the momentum of the moving parts will be correspondingly smaller.

CONCLUSIONS.

In general appearance and workmanship the two instruments are about the same; both can be manipulated with equal facility and diagrams drawn with them equally well.

The pencil movement is better and the range of springs of the same tension greater in the Tabor than in the Thompson instrument, in the ratio of 5 to 4.

The tension of the spring of the paper drum can be more easily and quickly adjusted in the Thompson than in the Tabor indicator.

The piston of the Thompson indicator fits the cylinder nearly steam tight, while that of the Tabor allows considerable steam to pass by it at the higher pressures, making it difficult to take a clean card with the instrument.

The Board believed this to be a serious defect, and one that will grow with the wear of the instrument, and which will sooner or later affect its accuracy as a measure of power, to say nothing of the disagreeable effects of the escaping steam.

It appeared to the Board that the makers of the Tabor indicator, in their efforts to reduce the weight of the moving parts, had made the walls of the piston so thin that under the higher pressures they would bend in and allow steam to escape by them. A slight increase in thickness would probably remedy this defect and prevent the escape of steam past the piston.

TABLE I.—*Comparison of Ashcroft Manufacturing Company's pressure-gauge for testing indicators and American Steam Gauge Company's compound gauge No. 106705, with mercury column. Department of Steam-Engineering, navy-yard, New York.*

[illegible]	Ashcroft Manufacturing Company's test-gauge.			Difference.	Mercury column, pounds.	American Steam Gauge Company's compound gauge No. 106705.			Difference.
	Up.	Down.	Mean.			Up.	Down.	Mean.	
90	88.375	87.875	88.125	—1.875	......	....	....	....	....
85	84.000	83.000	83.500	—1.500	......	....	....	....	....
80	79.100	78.250	78.675	—1.325	......	....	....	....	....
75	74.250	73.000	73.625	—1.375	......	....	....	....	....
70	69.500	67.875	68.6875	—1.3125	......	....	....	....	....
65	64.750	62.900	63.825	—1.175	......	....	....	....	....
60	60.000	58.000	59.000	—1.000	60	59.500	58.500	59.000	—1.0000
55	55.125	52.900	54.012	—0.988	55	54.750	53.375	54.0625	—0.9375
50	50.250	48.000	49.125	—0.875	50	49.750	48.500	49.125	—0.8750
45	45.875	43.300	44.587	—0.413	45	44.500	43.500	44.000	—1.0000
40	40.800	38.400	39.600	—0.400	40	40.000	38.500	39.250	—0.7500
35	35.875	34.000	34.937	—0.063	35	35.000	33.500	34.250	—0.7500
30	30.500	29.000	29.750	—0.250	30	30.000	28.750	29.375	—0.6250
25	25.500	24.000	24.750	—0.250	25	25.000	23.900	24.450	—0.5500
20	20.750	20.000	20.375	0.375	20	20.000	19.375	19.6875	—0.3125
15	15.875	14.875	15.375	0.375	15	15.125	14.500	14.8125	—0.1875
10	11.000	9.900	10.450	0.450	10	10.500	9.750	10.1250	0.1250
5	5.500	4.900	5.200	0.200	5	5.375	4.900	5.1375	0.1375
0	0.000	0.000	0.000	0.000	0	0.000	0.000	0.000	0.000
			Mean	—0.6061	*Ins.*		*Inches*	Mean	—0.5173
					5	....	5.000	....	....
					10	....	10.000	....	....
					15	....	14.100	....	....

TABLE II.—*The mean readings from atmospheric line of the different scales taken simultaneously with the Thompson and Tabor indicators under the same pressure of steam, with the difference between the corresponding readings of the up and down scales at each interval of pressure.*

Pressure per gauge.	20-pound spring. Thompson. Up.	Thompson. Down.	Thompson. Double friction in pounds.	Tabor. Up.	Tabor. Down.	Tabor. Double friction in pounds.	Pressure per gauge.	30-pound spring. Thompson. Up.	Thompson. Down.	Thompson. Double friction in pounds.	Tabor. Up.	Tabor. Down.	Tabor. Double friction in pounds.
	33.519	33.942	0.423	31.089	31.135	0.046	60	63.390	63.945	0.555	61.844	61.975	0.131
—	27.933	28.417	0.484	25.865	26.098	0.233	55	58.083	59.595	1.512	56.762	57.113	0.351
20	22.267	22.596	0.329	20.680	20.953	0.273	50	51.800	53.566	1.766	51.606	52.219	0.613
15	16.516	16.467	—0.049	15.275	15.392	0.117	45	47.423	49.109	1.686	46.309	47.025	0.716
10	10.786	10.596	—0.190	10.204	10.221	0.017	40	42.226	43.879	1.653	41.050	41.802	0.752
5	5.487	5.471	—0.016	5.391	5.540	0.149	35	36.781	38.553	1.772	35.719	36.700	0.981
0	....	0.292	0.292	....	0.217	0.217	30	31.031	32.391	1.360	30.679	31.532	0.853
		Mean,	0.1819,		Mean,	0.1331.	25	26.244	27.797	1.553	24.488	25.619	1.131
0	....	....	....	....	....	....	20	20.736	22.095	1.359	20.229	21.044	0.815
5	4.716	4.768	—0.048	4.908	4.974	0.066	15	15.569	16.582	1.013	15.238	16.396	1.158
10	9.387	9.612	0.225	10.050	[illegible]	[illegible]	10	10.416	11.122	0.706	10.294	10.819	0.525
15	14.617	14.854	0.237	15.731	16.007	0.276	5	5.219	5.689	0.470	5.256	5.377	0.121
20	18.829	19.087	0.258	20.529	20.769	0.240	0	....	0.472	0.472	....	0.094	0.094
25*	23.229	23.525	0.296	25.691	26.102	0.411			Mean,	1.2213		Mean,	0.6342
		Mean,	0.1650		Mean,	0.1772							

Above zero 0.292 pounds = 0.5960 inches.

Double friction.....0.7640

Above zero 0.217 pounds = 0.4429 inches.

Double friction 0.6291.

*Twenty-five inches; all the vacuum that could be maintained.

TABLE II.—*The mean readings from atmospheric line of the different scales taken simultaneously with the Thompson and Tabor indicators, etc.*—Continued.

Pressure per gauge.	40-pound spring. Thompson. Up.	Thompson. Down.	Thompson. Double friction in pounds.	Tabor. Up.	Tabor. Down.	Tabor. Double friction in pounds.	Pressure per gauge.	60-pound spring. Thompson. Up.	Thompson. Down.	Thompson. Double friction in pounds.	Tabor. Up.	Tabor. Down.	Tabor. Double friction in pounds.
90*	....	....	....	....	....	....	90	95.637	96.399	0.762	92.575	92.881	0.[illegible]
80	85.633	87.004	1.371	82.067	83.034	0.967	80	81.825	86.012	1.187	82.200	82.794	0.594
70	75.612	76.787	1.175	71.958	72.642	0.684	70	74.200	75.374	1.174	71.875	72.681	0.[illegible]
60	64.708	66.054	1.346	61.492	62.575	1.083	60	63.450	64.737	1.287	61.562	62.951	1.[illegible]
50	54.154	55.383	1.229	52.433	52.559	0.126	50	52.962	53.624	0.662	51.437	52.731	1.[illegible]
40	43.275	44.283	1.008	41.508	42.259	0.751	40	42.312	43.062	0.750	41.260	42.281	1.[illegible]
30	32.463	33.425	0.962	31.342	32.117	0.775	30	31.600	32.362	0.762	30.920	32.181	1.[illegible]
20	21.554	22.200	0.646	21.167	21.909	0.742	20	20.912	21.512	0.600	20.400	22.394	1.[illegible]
10	10.569	11.191	0.622	10.792	11.384	0.592	10	10.608	10.924	0.316	10.437	11.502	1.0[illegible]
0	....	0.254	0.254	....	0.367	0.367	0	....	0.362	0.362	....	0.369	0.3[illegible]
			Mean, 0.9570			Mean, 0.6763				Mean, 0.7862			Mean, 1.0[illegible]

Mean double friction of Thompson over the Tabor indicator, 23.4 per cent.

*** Limit of Thompson spring about 85 pounds per gauge.**

TABLE III.—*Dynamic tests of indicators.*

Number of cards.	Simultaneous cards, taken from machine-shop engine, with Thompson and Tabor indicators fitted with 20-pound springs. Mean pressure. Thompson.	Mean pressure. Tabor.	Mean pressure. Difference.	Indicated horse-power. Thompson.	Indicated horse-power. Tabor.	Indicated horse-power. Difference.	Simultaneous cards, taken from machine-shop engine, with Thompson and Tabor indicators fitted with 40-pound springs. Mean pressure. Thompson.	Mean pressure. Tabor.	Mean pressure. Difference.	Indicated horse-power. Thompson.	Indicated horse-power. Tabor.	Indicated horse-power. Difference.
1	13.30	12.65	.65	26.797	25.487	1.310	14.60	14.30	.30	29.842	29.229	.6[illegible]
2	13.80	13.20	.60	27.803	26.595	1.208	14.80	14.00	.80	30.251	28.616	1.6[illegible]
3	13.65	12.85	.80	27.502	25.890	1.612	13.90	13.20	.70	28.412	26.981	1.4[illegible]
4	13.45	12.65	.80	27.099	25.487	1.612	13.50	12.75	.75	27.594	26.061	1.5[illegible]
5	13.30	12.55	.75	26.797	25.286	1.511	14.60	14.35	.25	29.643	29.122	.5[illegible]
6	13.47	12.60	.87	26.942	25.203	1.739	13.00	12.45	.55	26.572	25.448	1.1[illegible]
7	13.62	12.58	1.01	27.243	25.163	2.080	12.15	11.85	.30	24.835	24.221	.614
8	14.20	13.25	.95	28.403	26.503	1.900	12.52	12.50	.02	25.591	25.550	.041
9	13.90	12.85	1.05	27.803	25.702	2.101	12.70	12.20	.50	26.144	25.115	1.0[illegible]
10	14.30	13.30	1.00	28.603	26.603	2.000	12.50	12.00	.50	25.550	24.528	1.0[illegible]
1	16.95	16.16	.79	33.161	31.615	1.516	15.70	15.10	.60	33.008	31.746	1.2[illegible]
2	15.80	14.60	1.20	31.372	28.990	2.382	14.00	12.75	1.25	29.025	26.433	2.5[illegible]
3	15.70	14.28	1.22	30.664	28.250	2.414	14.35	14.00	.35	28.886	28.207	.6[illegible]
4	15.45	14.10	1.35	30.677	27.997	2.680	17.00	16.43	.57	33.259	32.144	1.115
5	17.00	15.65	1.35	34.003	31.303	2.700	14.75	14.60	.15	29.718	29.416	.3[illegible]
6	15.25	13.90	1.35	30.703	27.803	2.700	18.40	17.25	1.15	36.535	34.252	2.2[illegible]
7	14.20	13.00	1.20	28.403	26.003	2.400	17.20	16.50	.70	35.157	33.726	1.431
8	16.20	14.70	1.50	32.403	29.403	3.000	16.20	15.70	.50	33.113	32.091	1.0[illegible]
9	15.20	13.80	1.40	30.403	27.603	2.800	15.50	15.00	.50	31.682	30.660	1.0[illegible]
10	12.65	12.35	.30	25.303	24.702	.601	14.85	14.50	.35	30.353	29.638	.715
Means	14.5595	13.5510	1.0085	20.0942	27.0794	2.0148	14.6110	14.0715	.5395	29.7585	28.6592	1.0[illegible]
	Power measured by the Thompson 7.4403 per cent. greater than measured by the Tabor instrument.						Power measured by the Thompson 3.835[illegible] per cent. greater than measured by the Tabor instrument.					

NOTE.—First series: Thompson indicator on left-hand pipe. Second series: Thompson indicator on right-hand pipe.

Scale o[0].

Tabor

Up.		Down.		Down.

Thomp

COMPARATIVE TESTS OF "MAGNOLIA" METAL AND "A" WHITE BRASS MADE BY A BOARD OF ENGINEER OFFICERS, COMPOSED OF PASSED ASSISTANT ENGINEER W. A. WINDSOR, U. S. NAVY, AND ASSISTANT ENGINEER F. C. BOWERS, U. S. NAVY, AT THE NEW YORK NAVY-YARD, 1887 AND 1888.

There were two samples of magnolia metal submitted by the manufacturer, which are referred to below as magnolia metal No. 1 and magnolia metal No. 2. The "A" white brass was a sample of a composition that has been in use in marine engines for some time, and was supplied by the Government. Two distinct tests were made; the destructive test, with the view of fusing the metals by friction, and the frictional test, made to determine the comparative anti-friction values of the metals. Different machines, described below, were used for each test.

DESCRIPTION OF THE METALS.

These metals are of the kind known as white or soft alloys, in which such metals as antimony, tin, lead, and zinc are combined; they are intended for anti-friction metals, and resemble Babbit's metal somewhat in appearance. When broken, they present a short-grained, grayish fracture, the "A" metal being more brilliant and brittle than the magnolia metals; of the latter, the fracture of No. 1 is darker than that of No. 2. The color of the fracture of the magnolia metals approaches that of lead, which no doubt is the predominant ingredient, while that of the "A" metal approaches more closely that of tin and zinc, which probably are its principal ingredients. Magnolia metal No. 1 contains a quantity of refined plumbago or graphite, mechanically mixed with the other ingredients; otherwise, the two magnolia metals are said to be identically the same. On breaking an ingot of magnolia metal No. 1, the line of demarkation of the precipitated graphite is visible. This peculiarity, and the unctuous feeling it has to the touch, are the characteristics which distinguish magnolia metal from nearly all other soft metals, and especially from the "A" white brass. Magnolia metal No. 1 only is manufactured and offered for sale, the No. 2 metal, as here distinguished, having been supplied for experimental purposes only, in order to test the value of the alloy without plumbago.

In casting Magnolia metal in ingots, the longer the metal remains fluid, the greater will be the quantity of plumbago that is precipitated. If the mold is cold, the plumbago will collect near the center of the ingot or be more evenly distributed through out the mass; if it is warm, the plumbago will settle towards the lower surface, as shown by the fracture. Pieces from one-eighth to three-eighths inch thick were cast and allowed to cool in the atmosphere, and when broken, showed distinctly a dark and a light part, the dark part in each being from one-half to three-fourths the thickness of the metal, though in all cases enough plumbago remained in the upper part to give some of its anti-frictional qualities to the metal. This settling of the plumbago will, no doubt, occur when the metal is poured as a lining for journal brasses, and therefore it should be poured in a brass with the wearing surface downwards and over a mandrel. In any case, the Magnolia metal requires a thorough stirring with a small stick of wood before and during pouring, and should be made only hot enough to scorch but not to quickly burn the wood. The same is true of the "A" white brass, for otherwise a metal poorly compounded will result. Magnolia metal has a co-efficient of expansion and contraction much larger than the "A" white brass, and has a large shrinkage indentation on the top surface of the ingots, while the "A" white brass has very little. For this reason it requires light pening with a hammer when poured into a brass, after it becomes thoroughly cooled, to tighten it in place.

MELTING POINTS OF THE METALS.

There not being an experimental furnace for this purpose, the melting points were obtained in a rather crude manner over a charcoal fire, the metals being melted in an iron ladle and temperatures taken by a mercurial thermometer which corresponded well with others at from 50° to 200°. There was no means of ascertaining how exact it was at the higher temperatures. Pieces of the different metals were broken off nearly the same size and a quarter-inch hole drilled in each of sufficient depth to entirely inclose the cylindrical bulb of the thermometer, and within about three-thirty-secondths inch of being through. The bulb was in contact with the sides and bottom of the hole. The pieces were well heated, gradually, by turning them in the

ladle while over the fire till they were found to be about 425° to 430°, and then t thermometer was inserted permanently into the holes and heat again gradually a plied, the ladle being removed at short intervals and tilted to see if any portion w melted.

As soon as a globule of the metal was observed, the indications of the thermome were noted as the melting points. Several pieces of each metal were thus treated different melting point being obtained for almost each piece of the same metal.

Table A gives the average melting points as near as could be obtained by this cr method, for the first, second, and third meltings of each metal.

TABLE A.—*Melting points of Magnolia metals Nos. 1 and 2 and of "A" white brass.*

First melting.			Second melting.			Third melting.		
Magnolia No. 1.	Magnolia No. 2	"A."	Magnolia No. 1.	Magnolia No. 2.	"A."	Magnolia No. 1.	Magnolia No. 2.	"A."
°	°	°	°	°	°	°	°	°
432	432	455	465	470	480	5[illegible]2	5[illegible]	48[illegible]
444	442	455	469	475	490	4[illegible]5	497	4[illegible]5
440	446	4[illegible]0	478	4[illegible]0	4[illegible]5	499	503	490
467	463	465	473	463	471	50[illegible]	494	485
460	460	478	478	474	475	5[illegible]3	....	497
457	457	450	4[illegible]0	470	470	503	....	493
450	450	460.5	473.8	472.5	478.5	500.3	498.5	490

Two samples were taken from other ingots of Magnolia No. 1 and "A" white br and melted once:

Magnolia metal No. 1.	"A" metal.
°	°
455	478
4[illegible]0	474
457.5	476

In all probability the melting point could be more accurately determined with pro melting apparatus, but at the same time different observers might obtain widely va ing results, depending on the metal, accuracy of the thermometers, and observati thus the melting points of lead and tin are given by different authorities as from 5 to 630° and 421° to 442°, respectively, though 630° and 442° are the generally accep melting points of each. The board found the melting points of lead and tin to be, w one trial, 590° and 426°, respectively, with the same thermometers used for the ot metals. In the preliminary report, the average melting points were given for the f melting of a number of pieces taken from an ingot of each metal, as it was thought t the metals would be most likely used in that way; but, from experience, the sec melting of soft metals is almost as frequently used, and even the third and fo (and greater number) meltings used.

It was deemed best to give the melting point for the first, second, and third fi From the table it will be seen that the melting point changes for every time the is melted; probably a limit would be reached when certain ingredients became v tilized or burned out.

In melting the "A" white brass for the first melting it became soft at a temp ture of about 360° to 370°, while still retaining its form, and could be easily scr off with a small stick or pencil and could be crushed with it, presenting a gran appearance when thus disturbed, but did not flow till the temperature given for melting point was reached. For the second melting it assumed the same condi at a temperature of about 370° to 380°. The Magnolia metals retained their form hardness until near the melting point and then melted quickly, like lead. In coo it was noticeable that for pieces cast the same size, the "A" white brass retai heat a much longer time than the Magnolia metal.

The point at which the metal began to solidify was obtained by inserting the t mometer in the molten mass and noting the temperature when the metal becam hard as to just begin to nip the thermometer; also, by inclosing the bulb in a v thin metallic case and inserting it in the liquid. In both cases the temperatu were 450° and 450° (mean) as previously found for the first melting.

SPECIFIC GRAVITY.

The specific gravity of the three metals was found by the method of displacement, and was obtained separately, from pieces taken from an ingot, for the light and dark parts of Magnolia metal No. 1, and also for that part in which the plumbago was supposed to be well distributed. Pieces were also taken from the cylindrical plugs of the three metals tested and the specific gravity found for each. The average was as follows:

	Magnolia metal.		"A" metal.
	No. 1.	No. 2.	
Mean of light part	9.972	9.917	7.715
Mean of dark part	10.104	....	....
Mean..........	10.038	....	....

The specific gravity of that part of the Magnolia metal in which the plumbago was supposed to be well distributed was found to be 10.086, a number somewhat higher than the mean of the light and dark parts, but probably nearly correct. It is probable that the specific gravity of these white metal alloys changes with the number of times the metals have been melted previously to casting into ignots, for it seems that there is no uniformity in the specific gravity of either the "A" metal or Magnolia metal, the first named varying more in this respect than Magnolia. This is due probably to the want of diligent care in mixing the component parts in exactly the same proportion and to the number of times the metal has been remelted, some of the ingredients becoming more or less volatilized during each melting It therefore seems likely that in any of the white or soft metal alloys, few ingots can be found of precisely the same specific gravity, unless they should happen to be cast from the same melting and in ingots quite thin.

DESTRUCTIVE TEST.

Description of the machine used.—A new spindle was made for the tail stock of a lathe and the end threaded for a universal chuck. A similar chuck was secured on the head stock of the lathe. Two steady-rests were bolted to the shears of the lathe, between the chucks and at suitable distances from them and each other to prevent any undue strain on the metal to be tested. The jaws of these rests held brass bearings in which revolved a shaft, the ends of which were turned to conical frustrums, the bases of these being $1\frac{1}{8}$ + inches in diameter (1 square inch area of cross section), the small ends, $\frac{3}{8}$ inch in diameter, and their axial lengths, $1\frac{1}{16}$ inches. The shaft was driven by a $3\frac{1}{2}$-inch belt from a counter shaft, which in turn was driven by another $3\frac{1}{2}$-inch belt from the line shaft of the machine-shop (second floor). The conical shaft moved easily, axially, in the brass bearings, and when revolving free made from 2,250 to 2,300 revolutions per minute, depending on the speed of the machine-shop engine, which was from 68 to 72 revolutions per minute. A lever, bent at right angles, was placed against the tail stock; the long arm was graduated and held known weights, which were moved as desired when changing the pressure against the conical ends of the shaft. The metals to be tested were cast into cylindrical pieces of the same size and reamed to suit the conical spindles. A $\frac{5}{8}$-inch oil hole was drilled about the middle, and a $\frac{3}{16}$-inch oil hole at each end of cones, and oil grooves cut in their wearing surfaces. A $\frac{1}{4}$-inch hole was drilled in each cone for the cylindrical bulb of a high grade thermometer, to within $\frac{1}{16}$-inch of being through to the wearing surface. The metals were then placed in the jaws of the chucks. It was necessary to overcome the friction of the chuck and tail stock. By means of a spring balance, it was found, that with the spindle of the stock well lubricated, it required 30 pounds to move the chuck and one cylindrical plug one-half inch. This was eliminated by suspending a small weight on the lever end; thus equipped, the spindle moved easily in the tail stock with the weight of chuck and metal on one end.

Method of conducting the experiment.—A cylindrical piece of the metal to be tested was secured in each chuck and carefully aligned with the axis of the shaft by trial; the machine was put in operation and gradually increased weights applied, oil being copiously supplied to the cones to bring the conical wearing surfaces of the metals to proper bearings. When this was accomplished and the metals again cool to about the same temperature, the test was commenced by noting the temperature of the air in room and of each metal. While the machine was in operation, these observations were noted every minute until one of the metals fused. The revolutions were taken at intervals by one of Taylor's speed indicators. The bearings were kept constantly supplied with sperm oil so as to gradually heat the metals up to fusion, and to pre-

vent the abrasion of and injury to the bearing surfaces. Generally, the experiment was commenced with 100 pounds pressure per square inch, except in the case of those metals for which it had been ascertained that a greater pressure at starting could be applied without any great and sudden increase of temperature.

All tests in which the "A" white brass was one of the competing metals were begun with 100 pounds pressure per square inch, and gradually increased by 50 pounds, as it had been demonstrated during the wearing-down process that this metal heated and abraded much more rapidly than the opposing metal, even when changed to opposite ends of the machine.

The following tests were made:

(1) "A" white brass against Magnolia metal No. 1.

(2) The same pieces of metal as used in the first experiment, but their positions in the machine reversed.

(3) "A" white brass against Magnolia metal No. 2.

(5) Two pieces of Magnolia metal No. 1.

(6) Two pieces of "A" white brass.

(7) The unfused piece of Magnolia metal No. 1 (experiment 5), and the unfused piece of the "A" white brass (experiment 6).

The pairs of pieces were approximately of the same size for each experiment. Table B gives the results of these different tests, averaged for each change of pressure.

FRICTION TEST.

Description of the machine used.—The machine is similar to that used by Mr. Beauchamp Tower, of England, in the friction experiments made for the Society of Mechanical Engineers, London, England, in 1883 and 1884. It consists of a shaft revolving in suitable bearings, between two of which is a steel journal, (keyed on the shaft,) on which the test piece is placed.

Only the top half of the bearing to be tested is used with this machine, and in these particular tests this was lined with the soft metals to be tested. A yoke frame (to the under side of which is suspended a platform on knife edges) rests on and encompasses the bearing. On this platform the weights are placed for producing the pressure on the test bearings. There are two knife edges, one above the other, which allow the yoke frame and the weighted platform to move independently of each other, and thus prevent any influence of the weight on the journal other than that caused by direct downward pull. The knife edge on which the weight is suspended, when in its normal position, is directly under and 5 inches from the center of the shaft. A long, light arm or pointer, with a needle in the extreme end, is attached to one side of the yoke frame and is counterbalanced by a weight on the opposite side. In this particular test the length of the pointer, from center of shaft to needle end, was 100 inches. The bearing was lubricated by the journal which revolved in a rectangular pan of oil under it and resting on the lower part of the yoke frame.

This is considered the most perfect method of lubrication, as well as the most economical for this machine. The total weight of all parts suspended and resting on the steel journal was 320 pounds. The dimensions of the steel journal and bearing surface of metal of journal were: Diameter of journal 4 inches, length 3½ inches; wearing surface of metal 3½ inches long, chord of arc of contact 3 inches, giving a circumference of journal of 1.0472 feet and a projected area of wearing surface of 10 square inches. The shaft was driven by a 4 inch belt from a counter-shaft, which again was driven by similar belts, for ahead and reverse, from the line-shaft of machine-shop.

A positive motion counter (water-meter), connected to one end of this shaft, indicated the revolutions to be about 484 as a minimum average, to about 500 as a maximum average, depending on the amount of work the machine-shop engine had to do. Thermometers were inserted in the oil bath and in a recess in top of metal. In this machine the co-efficient of friction is obtained by means of the angle of deviation of the knife edge from a vertical line passing through the center of the journal, in terms of the radius of the journal, and is independent of the weight entering directly into the calculation.

Manner of making the experiment.—Sufficient oil was put in the pan so that, when adjusted in position, the journal was in the oil to the depth of about five-sixteenths inch; the machine was then operated for several hours ahead and reverse with each metal, to wear them down to a proper bearing surface for the whole arc of contact. After having obtained a perfect bearing for one metal, and before commencing the observations, all weights were removed from the platform, and then enough weights put on to make the total 1,000 pounds, or 100 pounds per square inch of projected area of bearing surface. For all changes of weight, the center of gravity was brought directly under the center of the shaft before putting the machine in motion. The machine was now operated in one direction for one hundred minutes, the reading of the scale, from an established point, noted every ten minutes and averaged. It was then operated in the reverse direction for about fifteen minutes, to reverse the surface fibers of the metal; for, after running in one direction for some time and then reversing the

shaft, the friction at first is considerably greater than it is after running a short time, which, as Mr. Tower says, is probably owing to the change in the direction of surface fibers of the metal. After reversing, observations were again taken every ten minutes during the next run of one hundred minutes. These two runs constituted an experiment of two hundred minutes with 100 pounds per square inch. The machine, oil, and bearing were allowed to cool for the next experiment, which was made with the weight increased to 150 pounds per square inch, or a total weight of 1,500 pounds.

Each experiment was made by increasing the weight by 50 pounds per square inch, precisely as above described, till the limit of the capacity of the machine was reached. The difference of the readings of the scale for the two runs of one hundred minutes each gives the whole angular movement of the pointer, due to friction of the test metal on the journal and the viscosity of the thin film of oil between the metal and the journal. At the same time that the readings of the scale were taken, the revolutions per minute and the temperatures of the oil bath, the metal, and the air in the room were also taken.

Each metal was tested in precisely the same manner and with the same quantity of sperm oil as a lubricant. Table C gives the tabulated results of the two Magnolia metals, Nos. 1 and 2, and the "A" white brass, with increasing weights of 50 pounds per square inch.

The results of Table C were checked, approximately, by reversing the process of the change of weights and by running the machine for ten minutes in each direction for the Magnolia metals and twenty minutes for the "A" white brass. The data were taken as before, for each decrement of 50 pounds per square inch. The "A" white brass must be run a longer time than the Magnolia metals to bring the friction to the lowest amount, for a given change of weight on the wearing surface, and for this reason, the machine was run twenty minutes each way for the "A" white brass, instead of ten minutes, as for the Magnolia metal. Table D gives the results of the tests with each metal. Finally, the three metals were tested in the same manner, as above described, but with water as the lubricant and the machine operating for sixty minutes. In this experiment it was deemed best not to exceed 200 pounds per square inch for the "A" white brass, on account of its heating and requiring frequent change of water in the pan, for fear of injury to the steel shaft before the Magnolia metals were tested; besides, the machine would not turn successfully with any weight above 200 pounds per square inch. Magnolia metal No. 1 was tested up to 600 pounds per square inch, the temperature not rising high. Usually, clean water was used only after each run ahead and reverse for every change of weight, but in the case of the "A" white brass, the water had to be renewed several times to keep the temperature as low as possible. Table E gives the results of these tests.

As to the value of the "A" white brass and Magnolia metal for shaft bearings, the Board arrived at the following conclusions:

(1) Magnolia metal having plumbago in its composition is much superior as an anti-friction metal to the "A" white brass.

(2) As a lining for brasses they should both be used in as thin a body as will remain fixed in place, about three-eighths or one-half inch thick, and in slabs or surfaces as large as possible.

(3) The metals should not be overheated in melting. In the case of Magnolia metal it should be heated sufficiently to just scorch the soft pine stick with which it is stirred.

(4) Magnolia metal should be cooled quickly or poured into as cold a receptacle as is possible, in order to maintain an equal distribution of the graphite throughout the mass.

(5) To obtain the best results with Magnolia metal, it would be best when pouring it into a brass around a journal or mandrel to have the brass above the mandrel and in proper position. Poured in this way, that portion of the metal which contains the largest quantity of precipitated graphite will be the wearing surface. The mandrel should be made quite warm, so as not to chill the metal too suddenly at the wearing surfaces.

(6) In whatever way Magnolia metal is poured, it should not be flush with the metal of which it is a lining, but stand above it from one eighth inch to three-sixteenths inch when finished, and should be lightly peened or expanded, so as to fill the recesses well and retain the lining firmly in place. This should also be the case with the "A" white brass. Prolonged or heavy peening is not recommended.

(7) From the fact that the "A" white brass becomes soft and easily disintegrates at a temperature much below its melting point, it is useless as a bearing material when that temperature is reached.

(8) Magnolia metal operates better than the "A" white brass with water as a lubricant, the difference between its friction qualities, with water and with oil as lubricants, not being so marked as in the case of the "A" white brass under the same conditions.

(9) Magnolia metal requires less lubricant than the "A" white brass.

(10) It was recommended for use in the machinery of naval vessels.

TABLE B.

Date.	Revolutions per minute.	Velocity of rubbing surface.	Weight applied in pounds per square inch.	Time in minutes.	Temperatures.									Remarks.
					Of air.	At commencement.	Maximum.	Mean.	Mean increase.	At commencement.	Maximum.	Mean.	Mean increase.	
						Magnolia metal No. 1.				"A" white brass.				
Jan. 17, 1888	2,175.00	640.592	100	7	59	51	103	92	41	51	280	171.3	120.3	At 2.58 p. m. took temperatures and commenced the trial with 100 pounds per square inch. The "A," white brass heated rapidly. At 3.04 the oil holes in the white brass began choking with abraded metal and were completely choked one minute later. Temperature of "A" white brass 280°, and of magnolia 103°. Reamed the "A" white brass, the magnolia not requiring anything to be done to it. At 3.56 commenced the trial again. Results same as before.
	2,153.67	604.857	100	26	59	66	126	112.27	46.27	66	354	317.15	251.15	
	2,005.00	590.523	150	3	59	122	136	133.67	11.67	350	348	346.00	—4.00	
	2,073.26	610.611	104.16	36	59	67.6	122.36	110.11	42.33	86.75	341.88	291.19	170.67	
Jan. 19, 1888	2,006.25	590.89	100	21	57.76	52	111	101.52	49.52	52	328	266.57	214.57	Fused "A" white brass at temperature of 360°, magnolia being 130°. Oil holes and grooves of "A" white brass closed with fused and abraded metal. Magnolia slightly abraded; oil holes and grooves perfect.
	1,975.00	581.69	150	2	59	109	130	126.00	17.00	326	360	358.00	—2.00	
	2,003.53	590.09	106.52	23	57.86	56.95	112.65	103.64	16.69	75.82	330.7	274.6	95.73	
Jan. 20, 1888	1,978.33	582.67	100	16	56	52	158	129.56	77.56	54	344	279.93	225.93	White brass fused at 360°; ran five minutes longer, and temperature increased to 362°; temperature of magnolia, 244°.
	1,971.50	580.65	150	10	57	124	244	228.30	104.30	308	362	354.30	46.30	
	1,975.70	581.89	119.23	26	56.38	79.69	191.07	168.19	87.84	151.69	350.92	308.53	156.58	
						Magnolia metal No. 2.				"A" white brass.				
Jan. 24, 1888	2,073.17	610.60	100	30	52	46	140	108.5	62.5	46	86	80.33	36.33	"A" white brass fused at 360°. Temperature of magnolia, 380°.
	2,021.00	595.24	150	11	52	102	102	94.82	—7.18	80	86	84.00	4.00	
	2,024.30	596.22	200	18	53	91	102	97.67	6.67	86	103	98.94	12.94	
	1,988.30	585.61	250	11	53.5	96	114	107.82	11.82	96	121	113.91	17.91	
	2,035.00	599.36	300	15	52.0	114	135	123.60	9.60	120	132	123.73	3.73	
	2,046.50	602.75	300	14	56.0	58	113	97.43	39.43	58	122	103.43	45.43	
	2,035.00	599.36	350	15	56.0	112	200	206.13	94.13	122	134	127.13	5.13	
	2,001.67	589.51	400	15	56.0	210	350	308.27	98.27	122	135	130.6	8.6	
	1,945.30	572.95	450	15	56.0	340	370	356.53	14.53	130	146	140.27	10.27	

	1,941.00	571.67	500	15	56.0	350	380	371.20	21.20	138	156	148.07	10.07	
	1,905.00	561.08	650	9	56.0	366	386	368.44	2.44	138	366	291.78	63.78	
	2,005.00	590.63	298.51	168	54.18	156.08	216.30	192.70	36.82	97.6	132.19	116.44	19.88	
						Magnolia metal No. 1.				Magnolia metal No. 2.				
Jan. 20, 188-	2,096.00	617.13	300	27	54	50	220	127.7	77.7	50	172	151.74	101.74	Magnolia No. 1 fused at 400°; temperature of magnolia No. 2, 384°. Oil holes and grooves of magnolia No. 1 completely choked with abraded metal. No. 2 metal showed very little wear, oil holes and grooves being slightly closed with abraded metal.
	2,028.75	597.52	350	22	54	140	394	350.18	110.18	146	272	210.27	64.27	
	1,965.00	578.74	400	20	55	388	392	380.5	—7.50	188	202	193	5	
	2,018.23	603.29	450	11	55	378	404	400.27	22.27	202	206	201.73	—0.27	
	1,973.00	581.10	500	9	55	398	404	399.78	1.78	204	218	212.44	8.44	
	1,965.00	578.73	550	10	55	400	404	403	3	218	238	227.60	9.60	
	2,016.67	593.96	600	10	55	402	404	402.7	.70	223	232	226.12	3.12	
	1,990.00	586.10	400	9	58	91	392	376	285	82	202	176.77	94.77	
	2,017.50	594.20	470	10	58	384	394	288.2	4.20	180	252	199.00	19.00	
	1,992.50	586.84	580	10	58.5	380	392	387.1	7.10	238	346	309.40	71.40	
	1,991.67	586.60	680	13	59	385	398	390.77	5.77	346	374	367.77	21.77	
	2,000.00	589.05	732	8	59	388	390	385.75	—2.25	372	380	377.88	5.88	
	1,985.05	584.63	786	10	59	390	400	392.10	2.10	380	389	384.80	4.80	
	2,014.05	593.19	479.21	169	55.99	280.5	368.21	343.25	44.47	193.38	249.6	234.19	39.03	
						(a) Magnolia metal No. 1.				Magnolia metal No. 1.				
Jan. 28, 1888	2,042.50	601.58	150	8	52	48	104	93.63	45.63	48	98	85.63	37.63	The one piece of magnolia marked (a) reached a temperature of 344°, while the other piece fused at 360°. The first piece was in good condition, while the oil grooves and oil hole of the melted piece were choked with abraded meta'
	1,985.00	584.63	200	8	52	104	117	113	9.00	98	114	109.10	11.10	
	2,070.00	609.67	250	10	52	116	126	123.7	7.70	113	127	123.3	10.30	
	2,060.00	589.05	300	10	52	125	134	130.5	5.50	126	134	131.7	5.70	
	2,038.00	600.34	350	10	52	131	147	142.5	11.50	130	322	281.80	151.80	
	1,990.00	586.10	400	10	52	140	153	148.5	8.50	318	345	339.6	21.60	
	2,060.00	606.72	450	10	52.5	152	170	167.7	15.70	344	346	345.6	1.60	
	1,997.50	588.31	500	10	53	168	178	173.2	5.20	342	348	343	1.00	
	2,010.00	592.00	550	6	53	167	200	175.5	8.50	340	346	342.67	2.07	
	2,065.00	608.40	550	11	62	68	320	306.55	238.55	65	360	342.91	277.91	
	1,977.50	582.40	600	10	62	318	230	323.3	5.30	356	366	331.6	5.60	
	1,970.00	580.21	650	6	62	318	334	326.33	8.33	362	364	361.67	—0.33	
	1,982.50	583.90	680	10	62	318	341	334.10	16.10	364	366	363.9	—1.10	
	2,040.00	600.23	732	6	62	340	344	342.83	2.83	364	366	364.5	0.50	
	2,014.83	593.42	442.06	127	55.55	171.67	209.29	202.81	30.68	231.50	282.52	274.46	58.05	

TABLE B—Continued.

Date.	Revolutions per minute.	Velocity of rubbing surface.	Weight applied in pounds per square inch.	Time in minutes.	Temperatures. Of air.	At commencement.	Maximum.	Mean.	Mean increase.	At commencement.	Maximum.	Mean.	Mean increase.	Remarks.
						"A" white brass.				"A" white brass. (b)				
Jan. 31, 1888	2,035.00	599.36	100	9	64	70	260	237.33	167.33	68	102	96.33	28.33	The piece of "A" metal marked (b) reached 124°, while the other piece fused at 316°. The oil grooves and oil holes of the latter choked, while the former piece was in good condition.
	1,975.00	582.13	150	10	64	262	266	256.2	−5.80	104	118	112.40	8.40	
	1,850.00	544.77	200	10	64	252	310	294.8	42.80	115	130	122.20	7.20	
	1,850.00	544.77	250	0½	64	308	316	314.00	6.00	122	124	123.50	1.50	
	1,948.81	573.97	153.39	29½	64	200.81	279.93	264.50	58.02	97.05	117.28	111.00	13.92	
						(a) Magnolia metal No. 1.				"A" white brass. (b)				
Feb. 1, 1888.	2,050.00	603.78	100	9	66	65	114	97.11	32.11	64	98	84.11	20.11	Test of metal marked (a) against (b). "A" white brass fused at 280°. Temperature of magnolia, 204°; oil grooves and holes of "A" white brass choked, metal sticking to journal of arbor; magnolia in good condition.
	2,033.33	598.87	150	10	66	114	200	166.40	52.40	93	112	105.50	12.50	
	2,130.00	627.34	200	10	66	200	250	233.60	33.60	112	124	121.60	9.60	
	2,090.00	615.56	250	10	66	218	215	208.10	−9.90	122	280	204.00	82.00	
	2,076.48	611.58	176.92	39	66	151.41	196.82	178.33	26.92	98.61	153.77	129.95	31.33	

NOTE.—The temperatures were taken every minute. The results in each line are the means for each change of weight.

TABLE B—Continued.

SUMMARY.

Dates.	Revolutions per minute.	Velocity of rubbing surface.	Weight applied in pounds per square inch.	Time in minutes.	Temperatures. Of air.	At commencement.	Maximum.	Mean.	Mean increase.
Magnolia metal No. 1.									
Experiment of January 19, Magnolia No. 1 *vs.* "A" white brass	2,003.53	590.09	106.52	23	....	56.95	112.65	103.64	64.69
Experiment of January 20, Magnolia No. 1 *vs.* "A" white brass	1,975.70	581.89	119.23	26	....	79.69	191.07	168.19	87.84
Experiment of January 26, Magnolia No. 1 *vs.* Magnolia No. 2	2,014.05	593.19	479.21	169	....	286.50	368.21	343.45	44.47
Experiment of January 28, Magnolia No. 1 *vs.* Magnolia No. 1	2,014.83	593.42	412.06	127	....	171.67	209.29	202.81	30.68
Experiment of February 1, Magnolia No. 1 *vs.* "A" white brass	2,076.48	611.58	176.92	39	....	151.41	196.82	178.33	26.92
	2,017.42	594.18	389.53	384	....	206.53	271.203	253	41.20
Magnolia metal No. 2.									
Experiment of January 24, Magnolia No. 2 *vs.* "A" white brass	2,085.35	590.63	298.51	168	....	156.08	216.30	192.70	36.82
Experiment of January 26, Magnolia No. 2 *vs.* Magnolia No. 1	2,014.05	593.19	479.21	169	....	193.38	249.60	234.19	39.03
	2,009.71	591.81	388.86	337	....	174.73	232.95	213.44	37.92
"A" white brass.									
Experiment of January 19, "A" white brass *vs.* Magnolia No. 1	2,003.53	590.09	106.52	23	....	73.82	330.70	274.07	195.73
Experiment of January 20, "A" white brass *vs.* Magnolia No. 1	1,975.70	581.89	119.23	26	....	151.69	350.92	308.53	156.58
Experiment of January 24, "A" white brass *vs.* Magnolia No. 2	2,005.35	590.63	298.51	168	....	97.60	132.19	116.44	10.88
Experiment of January 31, "A" white brass *vs.* "A" white brass	1,948.81	573.97	153.39	29½	....	200.81	279.93	264.50	58.02
Experiment of February 1, "A" white brass *vs.* Magnolia No. 1	2,076.48	611.58	176.92	39	....	98.61	153.77	129.95	31.33
	2,006.37	590.93	233.01	285.5	....	111.57	186.31	163.81	51.63

NOTE.—The experiment of January 17, being of a preliminary character, is not entered in the summary.

TABLE C.—*Giving results of combined runs ahead and reverse, for friction tests of Magnolia metal and "A" white brass, for each change of weight, from 100 pounds per square inch to 600 pounds per square inch of projected area of bearing surface, by increasing weight 50 pounds per square inch at each change. Lubricant, sperm oil. February, March, and April, 1888.*

Metals.	Weight applied in pounds per square inch.	Time in minutes.	Revolutions.		Velocity of rubbing surface in feet per minute.	Temperatures.												Co-efficient of friction.	Comparative values as anti-friction metals from the co-efficients.
						Of air in room.				Of oil bath.				Of test metal.					
			Total.	Per minute.		At beginning.	Maximum.	Mean.	Mean increase.	At beginning.	Maximum.	Mean.	Mean increase.	At beginning.	Maximum.	Mean.	Mean increase.		
Magnolia No. 1	100	200	99,233	496.17	519.59	61.5	68.0	63.75	—0.75	61.0	106.0	90.5	26.50	66.0	104.0	88.80	22.80	0.0005	8.0432
Magnolia No. 2	100	200	97,460	487.30	510.30	60.5	64.0	61.19	1.40	66.0	96.0	87.6	21.10	67.0	94.0	84.10	17.10	0.00765	2.5845
"A" white brass	100	200	98,605	494.03	516.27	49.0	57.0	54.45	5.45	85.0	129.0	114.35	29.35	88.0	127.0	113.45	25.45	0.0197812	1.0000
Magnolia No. 1	150	200	99,420	497.10	520.56	62.0	64.0	62.45	0.45	68.0	94.0	85.65	17.65	63.50	92.0	83.60	13.60	0.002125	5.9705
Magnolia No. 2	150	200	97,855	489.27	512.57	62.5	64.0	62.55	0.05	68.0	98.0	90.95	22.95	69.0	95.0	87.45	18.45	0.0049187	2.5794
"A" white brass	150	200	99,175	495.88	519.28	51.0	55.0	53.10	2.10	80.5	132.0	113.40	32.90	80.0	129.0	111.35	31.35	0.0125875	1.0000
Magnolia No. 1	200	200	99,883	499.42	522.99	63.0	65.0	60.60	—2.40	68.0	95.0	84.50	16.50	70.0	94.0	83.30	13.30	0.002075	4.5572
Magnolia No. 2	200	200	97,980	489.90	512.50	64.5	68.0	65.75	1.25	73.0	100.0	93.00	20.00	71.0	98.0	89.40	18.40	0.003175	2.9781
"A" white brass	200	200	99,480	497.40	520.88	55.0	62.0	57.70	2.70	77.0	138.0	118.55	41.55	78.5	136.0	117.55	30.05	0.0094562	1.0000
Magnolia No. 1	250	200	98,870	494.35	517.68	56.5	62.0	56.20	—0.30	75.0	98.0	88.00	13.00	70.5	96.0	83.50	13.00	0.00190375	4.0288
Magnolia No. 2	250	200	96,915	484.87	507.76	65.0	69.0	65.20	0.20	74.0	102.0	94.00	20.00	72.5	98.0	92.90	20.40	0.002625	3.0599
"A" white brass	250	200	97,595	487.98	511.01	50.0	56.0	52.40	2.40	76.0	142.0	116.05	40.05	72.0	140.0	113.00	41.00	0.0080325	1.0000
Magnolia No. 1	300	200	98,802	494.01	517.33	55.5	58.0	56.00	0.50	69.0	100.0	90.20	21.20	67.5	95.0	84.85	17.35	0.00178125	5.4281
Magnolia No. 2	300	200	97,010	485.05	507.94	58.0	62.0	60.00	2.00	65.0	97.0	92.30	27.30	65.5	96.0	90.90	25.40	0.0023375	4.1362
"A" white brass	300	200	98,070	490.35	513.49	48.5	58.0	54.00	5.50	98.0	187.0	146.50	48.50	97.0	180.0	141.80	44.80	0.00966875	1.0000
Magnolia No. 1	350	200	99,005	495.03	518.39	56.0	60.0	57.85	1.85	73.5	108.0	87.15	14.65	71.5	104.0	87.75	16.25	0.00164375	4.7338
Magnolia No. 2	350	200	96,995	484.97	507.86	60.0	62.0	60.20	0.20	66.5	100.0	92.25	25.75	66.0	96.0	87.40	21.40	0.00205	3.7957
"A" white brass	350	200	97,955	489.78	512.80	51.0	62.0	55.30	4.30	80.0	184.0	140.90	60.90	76.0	176.0	133.05	57.05	0.00778125	1.0000
Magnolia No. 1	400	200	99,625	498.13	521.64	60.5	64.0	61.05	0.55	67.5	108.0	96.80	28.30	75.0	104.0	94.20	19.20	0.00164375	4.4448
Magnolia No. 2	400	200	97,495	487.47	510.38	61.5	66.0	62.05	0.55	68.5	104.0	93.95	25.45	67.0	100.0	89.55	22.55	0.00180	4.0581
"A" white brass	400	200	97,010	485.05	507.94	53.0	62.0	57.45	4.45	77.0	196.0	149.70	72.70	78.0	186.0	142.10	64.10	0.00730625	1.0000
Magnolia No. 1	450	200	99,400	497.00	520.46	56.0	61.0	56.15	0.15	77.0	104.0	97.00	20.00	80.0	103.0	94.15	14.15	0.00121875	4.6000
Magnolia No. 2	450	200	97,940	489.70	512.81	61.5	65.0	62.85	1.35	70.5	108.0	97.05	27.05	68.5	104.0	92.05	23.55	0.00161875	3.4629
"A" white brass	450	200	97,525	487.63	510.64	43.0	54.0	49.75	6.75	80.5	198.0	148.20	67.70	79.0	186.0	138.90	59.90	0.00560625	1.0000
Magnolia No. 1	500	200	98,760	493.86	517.11	52.0	58.0	53.45	1.45	62.0	106.0	90.95	28.93	62.0	100.0	86.45	24.45	0.00100875	3.7313
Magnolia No. 2	500	200	98,405	492.02	515.25	60.5	65.0	62.05	1.55	69.5	109.0	96.60	27.10	67.5	104.0	91.35	23.85	0.00129375	3.5228
"A" white brass	500	200	97,850	489.25	512.34	49.0	58.0	53.90	4.90	83.0	188.0	150.65	77.65	85.0	179.0	144.15	59.15	0.00546875	1.0000
Magnolia No. 1	550	200	99,145	495.73	519.12	56.0	61.0	58.05	2.05	65.0	109.0	97.40	32.40	69.5	104.0	92.00	22.50	0.0011875	4.4736
Magnolia No. 2	550	200	97,955	489.77	513.89	56.0	63.0	59.70	3.70	65.5	106.0	94.55	29.05	63.0	100.0	88.60	25.60	0.00121875	4.3486

"A" white brass	550	200	96,963	484.53	507.40	60.0	64.0	61.30	1.30	91.0	205.0	160.80	60.80	95.0	194.0	154.50	58.50	0.0063125	1.0000
Magnolia No. 1	600	200	100,030	500.15	523.76	59.5	64.0	61.15	1.65	82.0	106.0	95.75	13.25	81.5	104.0	93.90	12.40	0.00129875	3.4322
Magnolia No. 2	600	200	97,525	487.62	510.64	58.0	64.0	60.55	2.55	69.0	108.0	98.20	29.20	67.0	104.0	92.50	25.50	0.001075	3.5228
"A" white brass	600	200	95,725	478.63	501.22	57.0	66.0	59.55	2.55	102.5	184.0	147.80	45.30	93.5	177.0	140.20	46.70	0.004075	1.0000

MEAN QUANTITIES.

Magnolia No. 1	350	200	1,092,173	496.44	519.87	58.3	62.3	58.79	0.47	69.7	103.00	90.94	21.13	71.2	100.0	89.26	17.17	0.00210329	4.1061
Magnolia No. 2	350	200	1,073,505	488.00	511.03	60.7	64.7	62.01	1.34	68.8	102.54	93.68	25.00	67.6	99.0	89.65	22.02	0.00270568	3.1925
"A" white brass	350	200	1,075,895	489.04	512.12	51.5	59.4	55.35	3.85	84.5	171.18	136.99	53.30	83.8	164.5	131.82	48.00	0.00863647	1.0000

TABLE D.—*Giving results of combined runs ahead and reverse for friction tests of Magnolia metal and "A" white brass for each change of weight from 600 pounds per square inch to 150 pounds per square inch of projected area of bearing surface, by decreasing weight 50 pounds per square inch at each change. Lubricant, sperm oil. February, March, and April, 1888.*

Metals.	Weight applied in pounds per square inch.	Time in minutes.	Revolutions. Total.	Revolutions. Per minute.	Velocity of rubbing surface in feet per minute.	Temperatures. Of air in room. At beginning.	Of air in room. Maximum.	Of air in room. Mean.	Of air in room. Mean increase.	Of oil bath. At beginning.	Of oil bath. Maximum.	Of oil bath. Mean.	Of oil bath. Mean increase.	Of test metal. At beginning.	Of test metal. Maximum.	Of test metal. Mean.	Of test metal. Mean increase.	Co-efficient of friction.	Comparative values as anti-friction metals from the co-efficient.
Magnolia No. 1	600	20	10,000	500.00	523.60	58.5	59.0	58.50	....	81.5	93.0	83.00	6.55	75.5	87.0	81.50	6.00	0.00125	3.8166
Magnolia No. 2	600	20	9,715	487.28	810.25	59.0	59.0	59.00	....	93.5	97.0	94.75	1.25	87.5	90.0	88.50	1.00	0.0010000	4.7708
"A" white brass	600	40	18,955	473.87	496.24	56.5	62.0	58.25	1.75	119.0	162.0	135.00	16.00	106.0	151.0	119.35	13.35	0.0047708	1.0000
Magnolia No. 1	550	20	9,970	498.5	523.08	61.0	62.0	61.25	0.25	85.0	93.0	89.00	4.00	81.5	88.0	85.00	3.50	0.0013125	4.3095
Magnolia No. 2	550	20	9,760	488.0	511.03	62.0	62.0	62.00	....	71.5	84.0	79.75	8.25	68.5	78.0	75.00	6.50	0.00125	4.5253
"A" white brass	550	40	18,990	474.5	497.16	54.0	78.0	56.50	2.50	118.0	154.0	147.05	29.00	107.0	144.0	139.25	32.25	0.00565625	1.0000
Magnolia No. 1	500	20	9,995	499.7	523.34	64.0	65.0	64.00	....	91.5	99.0	95.00	3.50	88.0	96.0	91.00	3.00	0.0014375	4.0000
Magnolia No. 2	500	20	9,830	491.5	514.70	62.5	63.0	62.50	....	86.0	93.0	88.75	2.75	83.0	89.0	85.50	2.50	0.00159375	3.6078
"A" white brass	500	40	19,585	489.6	512.76	63.5	66.0	63.75	0.25	107.0	158.0	131.75	24.75	99.0	148.0	123.50	24.50	0.005750	1.0000
Magnolia No. 1	450	20	10,015	500.75	524.39	64.5	65.0	65.00	0.50	96.5	105.0	100.25	3.75	94.5	100.0	96.75	2.25	0.0015	3.0583
Magnolia No. 2	450	20	9,845	492.25	515.48	64.0	64.0	64.00	....	92.5	96.0	94.00	1.50	90.0	93.0	91.00	1.00	0.001875	3.1667
"A" white brass	450	40	19,670	491.75	514.96	68.0	69.0	68.25	0.25	151.0	166.0	161.75	11.75	145.0	158.0	155.25	10.25	0.0059375	1.0000
Magnolia No. 1	400	20	9,950	497.50	520.98	64.0	64.0	64.00	....	78.5	88.0	83.50	5.00	74.5	83.0	78.35	3.85	0.001875	3.3167
Magnolia No. 2	400	20	9,805	490.25	513.39	62.0	62.0	61.50	—0.50	79.0	87.0	83.50	4.50	77.0	84.0	81.50	4.50	0.00228125	2.7260
"A" white brass	400	40	19,520	488.00	511.03	63.0	69.0	64.75	1.75	116.0	158.0	139.75	23.75	112.0	150.0	132.75	20.75	0.00621875	1.0000
Magnolia No. 1	350	20	9,940	497.00	520.45	64.5	66.0	65.00	0.50	86.0	94.0	90.00	4.00	83.0	89.0	86.25	3.25	0.00203125	3.2461
Magnolia No. 2	350	20	9,845	492.25	515.48	61.0	62.0	61.75	0.75	89.0	92.0	90.25	1.25	86.5	90.0	88.50	2.00	0.0023755	2.7761
"A" white brass	350	40	19,520	488.00	511.03	70.0	70.0	69.75	—0.25	151.5	163.0	150.75	8.25	145.0	157.0	154.50	9.50	0.00659375	1.0000
Magnolia No. 1	300	20	9,970	498.50	522.03	68.0	68.0	68.00	....	85.0	94.0	89.50	4.50	82.0	88.0	85.25	3.25	0.00215625	4.0000
Magnolia No. 2	300	[illegible]	9,845	492.25	515.48	61.5	62.0	61.25	—0.25	92.0	94.0	93.00	1.00	90.0	92.0	91.00	1.00	0.0025625	3.3658
"A" white brass	300	40	19,415	485.40	508.28	65.0	66.0	64.50	—1.50	93.0	146.0	124.75	31.75	82.5	139.0	118.25	25.75	0.008625	1.0000
Magnolia No. 1	250	20	9,985	499.25	522.84	69.0	60.0	69.00	....	93.5	96.0	95.00	1.50	89.0	92.0	91.25	2.25	0.002375	4.0657
Magnolia No. 2	250	20	9,735	486.75	509.72	60.0	60.0	60.00	....	91.0	94.0	93.50	2.50	90.0	92.0	91.75	1.75	0.002755	3.5117
"A" white brass	250	40	19,500	489.73	512.87	67.[illegible]	69.0	68.00	0.50	130.5	152.0	140.75	10.25	134.0	140.0	144.25	10.25	0.00965625	1.0000
Magnolia No. 1	200	20	9,975	498.75	522.29	68.[illegible]	69.0	68.50	....	94.0	98.0	95.50	1.50	91.0	94.0	92.25	1.25	0.00275	3.9204
Magnolia No. 2	200	20	9,845	492.25	515.48	61.0	63.0	61.75	0.75	93.5	94.0	91.00	0.50	91.5	92.0	92.00	0.50	0.00284375	3.7911
"A" white brass	200	40	19,468	486.70	509.64	68.5	71.0	69.75	1.25	144.5	160.0	153.00	8.50	140.0	154.0	147.75	7.75	0.01078125	1.0000
Magnolia No. 1	150	20	9,995	499.75	523.84	57.5	59.0	57.75	0.25	68.0	75.0	72.25	4.25	64.5	72.0	68.00	3.50	0.0031875	4.0019
Magnolia No. 2	150	20	9,860	493.00	516.97	61.5	62.0	61.75	0.25	70.0	80.0	74.00	4.00	67.5	76.0	70.75	3.25	0.00471875	3.3112

"A" white brass	150	40	19,535	488.37	511.47	62.0	68.0	65.50	3.50	113.0	128.0	113.25	20.25	106.0	135.0	128.75	22.75	0.015625	1.0000
Magnolia No. 1	100	20	9,925	496.25	519.68	59.5	60.0	59.50	....	76.0	80.0	78.00	2.00	72.5	76.0	74.50	2.00	0.00478125	4.0000
Magnolia No. 2	100	20	9,865	493.25	516.55	62.0	62.0	62.00	....	81.0	83.0	82.00	1.00	77.0	80.0	78.50	1.50	0.00571875	3.3442
"A" white brass	100	40	19,490	487.25	510.25	68.5	70.0	68.25	-0.25	126.0	142.0	136.25	10.25	124.0	140.0	134.00	10.00	0.019125	1.0000

MEAN QUANTITIES.

Magnolia No. 1	350	20	109,720	498.96	522.51	63.54	65.09	63.68	0.14	85.09	91.36	88.73	3.64	81.45	89.54	84.55	3.10	0.00224152	4.0045
Magnolia No. 2	350	20	107,980	490.82	513.97	61.50	61.91	61.59	0.09	85.30	90.36	87.95	2.59	82.59	87.00	84.86	2.27	0.00203352	3.4064
"A" white brass	350	40	213,738	485.77	508.80	64.23	67.09	65.11	0.88	125.32	154.45	141.09	15.77	119.14	147.45	136.15	17.01	0.00897632	1.0000

TABLE E.—*Giving results of combined runs ahead and reverse for friction test of Magnolia metal and "A" white brass for each change of weight from* 100 *pounds per square inch to* 600 *pounds per square inch of projected area of bearing surface, by increasing weight* 100 *pounds per square inch at each change. Lubricant, water.*

Metals.	Weight applied in pounds per square inch.	Time in minutes.	Revolutions.		Velocity of rubbing surface in feet per minute.	Temperatures.												Co-efficient of friction.	Comparative values as anti-friction metals from the co-efficient.
						Of air in room.				Of water bath.				Of test metal.					
			Total.	Per minute.		At beginning.	Maximum.	Mean.	Mean increase.	At beginning.	Maximum.	Mean.	Mean increase.	At beginning.	Maximum.	Mean.	Mean increase.		
Magnolia No. 1	200	60	58,585	488.21	511.25	60.0	62.0	60.25	0.25	61.6	90.0	73.00	12.00	60.0	84.0	69.58	9.58	0.00159375	12.4810
Magnolia No. 2	......	......	58,835	490.29	513.45	62.5	64.0	63.16	0.66	91.0	98.0	95.50	4.50	84.5	94.0	91.58	7.08	0.0049479	4.0202
"A" white brass	.....	......	58,170	484.75	507.63	59.5	66.0	62.66	3.16	85.0	154.0	131.41	46.41	78.0	144.0	123.16	45.16	0.0198916	1.0000
Magnolia No. 1	300	60	59,025	491.87	515.09	62.5	63.0	61.41	—1.09	59.5	80.0	72.58	13.08	60.0	77.0	69.66	9.66	0.00080208	....
Do	400	60	59,345	494.54	517.88	64.5	66.0	65.58	1.08	69.0	90.0	81.24	12.24	68.0	86.0	78.4	10.40	0.00129166	....
Do	500	60	58,650	488.75	511.82	72.0	76.0	73.33	1.33	77.5	142.0	105.33	28.83	77.0	130.0	98.58	22.58	0.002427	....
Do	600	60	58,870	490.58	513.74	68.5	71.0	68.25	—0.25	78.0	140.0	97.08	19.08	76.5	124.0	92.60	16.16	0.00275	....

NOTE.—It was thought unnecessary to test Magnolia No. 2 beyond 200 pounds per square inch.

Attempted this experiment with 500 pounds per square inch with "A" white brass; the machine would not turn until this weight was reduced to 200 pounds per square inch, at which pressure the experiment was begun. The machine turned easily with a weight of from 200 to 600 pounds per square inch with Magnolia No. 1, without altering belts.

REPORT OF CHIEF ENGINEER W. H. HARRIS, U. S. N., ON TESTS OF ALUMINUM AND NAVY BRONZES AT WATERTOWN ARSENAL, DECEMBER, 1887.

NAVY DEPARTMENT,
BUREAU OF STEAM-ENGINEERING,
Washington, December 20, 1887.

SIR: In obedience to orders of the 22d ultimo, I have visited Watertown, Mass., and Lockport, N. Y., to witness experiments at the former place upon specimens of aluminum bronze and brass, submitted for tensile tests by the Cowles Electric Smelting and Aluminum Company, of Lockport, N. Y., which place I visited after the tests at Watertown were completed.

In competition with the bronze specimens furnished by the above company, the Bureau directed that six specimens of the tin bronze usually used for propeller castings in the U. S. Naval Service be tested under like conditions.

All specimens tested were 15 inches in length between reference marks, and those finished all over were 1¾ inches diameter; those which were left as taken from the sand were slightly in excess of this diameter, 1.93 inches being the greatest diameter recorded.

A tabulated statement of the results of the tests is appended to this report.

A comparison can be made between the aluminum bronze castings marked D, and the tin bronze marked 4, 5, and 6; all these specimens being left as they came from the sand.

The average of the three tin bronze specimens being T. S., 22,400, E. L., 13,000. Elongation in 15 inches, percentage, 3.34. Reduction of area 7.98 per cent.

Comparing the specimens marked 9, 10, and 13 D, with the above, 9 D shows 53,000 — 22,400 = 30,600 pounds = 136 per cent. greater tensile strength; 19,000 — 13,000 = 6,000 pounds = 46 per cent. greater elastic limit; 6.2 — 3.34 = 2.86 = 85 per cent. greater elongation; 15.5 — 7.98 = 7.52 = 94 per cent. greater reduction of area. 10 D shows 69,930 — 22,400 = 47,530 pounds = 212 per cent. greater tensile strength; 33,000 — 13,000 = 20,000 pounds = 153 per cent. greater elastic limit; 3.34 — 1.33 = 2.01 = 60 per cent. less elongation; 7.98 — 3.3 = 4.68 = 59 per cent. less reduction of area. 13 D shows 46,500 — 22,400 = 24, 100 = 107 per cent. greater tensile strength; 17,000 — 13,000 = 4,000 = 30 per cent. greater elastic limit; 7.8 — 3.34 = 4.46 = 133 per cent. greater elongation; 19.6 — 7.98 = 11.62 = 145 per cent. greater reduction of area.

All of the above aluminum bronzes can be worked hot or cold, but no experiments have been made to my knowledge to determine their strength after such working.

It makes sound and sharp castings, its greater tensile strength allows the use of thinner and consequently lighter blades for propellers, and its great ductility allows of its being bent to nearly a right angle without showing cracks or flaws. I have no knowledge of any alloy of copper which as a casting combines the qualities which this material possesses.

At the works at Lockport, N. Y., I found that 30 tons of the high-grade aluminum bronze or 90 tons of aluminum brass per month is the present capacity of the works, but in designing the plant, arrangements were made for an increase of 100 per cent. in product, which the manager of the works, Mr. Dudley Baldwin, jr., states can be effected in ninety days.

Very respectfully,

WM. H. HARRIS,
Chief Engineer, U. S. N.

Engineer-in-Chief GEO. W. MELVILLE, U. S. N.,
Chief of Bureau of Steam-Engineering,
Navy Department, Washington, D. C.

Tests of aluminum and navy bronzes at Watertown Arsenal, December, 1887.

ALUMINUM BRONZE OR BRASS.

Mark or number.	Approximate composition.	Length between reference marks.	Diameter.	Area.	Tensile strength per square inch.	Elastic limit per square inch.	Elongation in 15 inches.	Reduction of area.	Diameter at fracture.
		Ins.	*Inches.*	*Sq. ins.*	*Pounds*	*Pounds.*	*Per ct.*	*Per ct.*	*Ins.*
1 C* ..	Cu., 91.5; Al., 7.75; Si., .75.	15	1.875	2.7612	60,700	18,000	23.2	30.7	1.56
7 C* ...	Cu., 88.66; Al., 10.; Si., 1.33.	15	1.875	2.7612	66,000	27,000	3.8	7.8	1.8
9 C* ...	Cu., 91.5; Al., 7.75; Si., .75.	15	1.875	2.7612	67,600	24,000	13.00	21.62	1.66
10 C* .	Cu., 90.; Al., 9.; Si., 1. ..	15	1.875	2.7612	72,830	33,000	2.40	5.78	1.82
11 C* ..	Cu., 63; Zn., 33.33; Al., 3⅓; Si., .33.	15	1.875	2.7612	82,200	60 to 73,000	2.33	9.88	1.78
13 C* ..	Cu., 92.; Al., 7.5; Si., .5.	15	1.875	2.7612	59,160	10,000	15.1	23.59	1.64
9 D†	Cu., 91.5; Al., 7.75; Si., .75.	15	1.9	2.84	53,000	19,000	6.2	15.50	1.75
10 D† ...	Cu., 90.; Al., 9.; Si., 1. ..	15	1.89	2.81	69,930	33,000	1.33	3.30	1.86
11 D† ...	Cu., 63.: Zn., 33.33; Al., 3.33; Si., .33.	15	1.9	2.84	70,400	55,000	0.4	4.33	1.86
13 D† ...	Cu., 92.; Al., 7.5; Si., .5.	15	1.93	2.93	40,550	17,000	7.8	19.19	1.73

NAVY-YARD BRONZE.

1	Cu., 88.; Sn., 10; Zn., 2. .	15	1.875	2.7612	18,000	10,000	2.5	4.7	1.83
2	......do..................	15	1.875	2.7612	24,500	11,000	8.2	6.8	1.81
3	......do..................	15	1.875	2.7612	22,500	11,000	5.8	10.89	1.77
4	......do..................	15	1.88	2.776	23,000	13,000	4.0	10.36	1.78
5	......do..................	15	1.88	2.776	20,570	13,000	2.33	6.3	1.82
6	......do..................	15	1.88	2.776	23,750	13,000	3.7	7.3	1.81

* Chill castings. † Dry-sand castings.

REPORT OF CHIEF ENGINEER W. H. HARRIS, U. S. N., ON TESTS OF NAVY BRONZE, AND BRONZE MADE BY THE DEOXIDIZED METAL COMPANY, AT WATERTOWN ARSENAL, AUGUST, 1888.

WATERTOWN ARSENAL,
Watertown, Mass., August 24, 1888.

SIR: I have the honor to transmit to the Bureau a summary of the results of tensile, transverse, and compressive tests made at this arsenal, upon material furnished by the Deoxidized Metal Company of Bridgeport, Conn., and that supplied by the navy-yards at Portsmouth, N. H., New York, and Norfolk, Va.

Three specimens for each test were furnished by the Deoxidized Metal Company, and two for each test by the above-mentioned navy-yards, making 27 specimens in all. Each specimen was stamped with a distinguishing mark upon each end; those from the navy yards with the initial of the yard and the numbers 1 and 2, and those from the Deoxidized Metal Company with the numbers 1, 2, and 3.

The requirements of the Bureau were that all specimens should be cast in green sand and be composed of copper, 88 parts, tin 10 parts, and zinc 2 parts, and the superintendent of the Deoxidized Metal Company informs me that the specimens furnished by his company were so cast and mixed; letters on file at the Bureau from the Chief Engineers of the several yards furnishing test specimens, show that the Bureau's instructions were complied with in each case. A tabulated statement of the results of the different tests is appended.

TESTS BY TENSION.

All pieces were 2¼ inches in diameter, and 15 inches between supports. Taking the mean of the results shown in the table of tests by tension, the deoxidized bronze shows a superiority of 65.8 per cent. in tensile strength, and 58 per cent. in elastic limit over the navy-yard bronzes, while the latter are superior to the former by 53 per cent. in ductility, and 36 per cent. in reduction of area. All the navy-yard specimens showed that the material was not well mixed, as when fractured the fracture showed large crystals of both copper and tin. The specimens from the Deoxidized Metal Company, on the contrary, showed, on fracture, a very fine, even grain of lavender color, and were fine specimens of casting. Short sections of tensile specimens have been forwarded by express to the Bureau, which will show the appearance of the fracture in both the deoxidized and navy-yard bronze.

TRANSVERSE TESTS.

All specimens were 1.5 inches square, 20 inches long, and 18 inches between supports, the load being applied at center of beam. In these tests the superiority of the deoxidized specimens was not as well marked, the maximum fiber strain, taking the mean of all specimens tested, being on rupture 18 per cent. greater in the deoxidized than in the other bronzes. All specimens were tested for specific gravity and hardness, the mean specific gravity being about the same in both kinds of bronze, while the hardness was 44 per cent. greater in the deoxidized than in the other bronze. The standard of hardness used is that of the late Major Wade, U. S. Ordnance Corps, where the hardness of gun bronze is taken at 3.33, this being the indentation produced by a pyramidal pointed punch under a pressure of 10,000 pounds. The relative hardness of the different specimens is consequently found by dividing the tabulated hardness by 3.33.

TESTS BY COMPRESSION.

All pieces were 1½ inches in diameter and 12 inches long. The deoxidized specimens showed a superiority over the other bronzes of 60 per cent. in strength and 23 per cent. in elastic limit. All specimens broke by triple flexure.

Deoxidized bronze, as furnished for the above tests, is remarkably close-grained and homogeneous. It turns well in the lathe and is susceptible of high polish. It

does not tarnish by exposure to the atmosphere as readily as the other bronzes tested, all of which have been exposed to like conditions since July 14, of this year, the deoxidized specimens being still intact while the others are perceptibly tarnished. The claim that it resists acids, and that two pieces can not be soldered, is not verified by experiment, as no difficulty was experienced in joining two pieces cut from tensile specimen marked 1, using chlorhydric acid.

The cost of this material is about 3 cents per pound more than for ordinary castings of the same composition, but not deoxidized, and the superintendent of the company states that no special facilities or skill are required to produce sound castings from the ingot metal.

Very respectfully,

WM. H. HARRIS,
Chief Engineer, U. S. N.

Engineer-in-Chief GEO. W. MELVILLE, U. S. N.,
Chief of Bureau Steam-Engineering, Navy Department, Washington, D. C.

Tests by tension.

DEOXIDIZED BRONZE.

Marks.	Alloy.	Diameter.	Area.	Ultimate strength per square inch.	Elastic limit per square inch.	Elongation in 15 inches.	Reduction of area.
		Inches.	*Square inches.*	*Pounds.*	*Pounds.*	*Per cent.*	*Per cent.*
1.......	Cu. 88, Sn. 10, Zn. 2...	1,882	2,782	28,110	16,431	1.5	2.3
2.......	....do	1,882	2,782	30,810	15,404	1.8	2.3
3.......	....do	1,883	2,785	29,000	14,000	1.7	2.4
Means..........				29,306	15,278	1.66	2.66

NAVY-YARD BRONZE.

Marks.	Alloy.	Diameter.	Area.	Ultimate strength per square inch.	Elastic limit per square inch.	Elongation in 15 inches.	Reduction of area.
P. 1....	Cu. 88, Sn. 10, Zn. 2 ...	1,875	2,761	14,700	10,000	0.9	1.5
P. 2....	......do	1,875	2,761	15,000	9,000	0.7	1.5
N. 1....	......do	1,875	2,761	17,100	11,000	1.7	2.7
N. 2....	......do	1,875	2,761	20,070	10,000	3.8	5.7
N. Y. 1.	......do	1,875	2,761	19,880	9,000	4.6	5.7
N. Y. 2.	......do	1,875	2,761	19,300	9,000	3.6	3.7
Means..........				17,675	9,666	2.55	3.43

Transverse tests.

DEOXIDIZED BRONZE.

Marks.	Alloy.	Applied loads. Total.	Applied loads. Maximum fiber, strain.	Deflection.	Specific gravity.	Hardness.	Bent before rupture.
		Pounds.		*Inches.*			°
1.......	Cu. 88, Sn. 10, Zn. 2....	8,310	66,480	2.05	8.4767	7.11	28
2	.....do	5,650	45,200	1.25	8.2027	4.79	22
3	......do	7,200	57,600	.87	8.5317	7.96	14
Means..........		7,053	56,426	1.39	8.4037	6.62	

NAVY-YARD BRONZE.

Marks.	Alloy.	Applied loads. Total.	Applied loads. Maximum fiber, strain.	Deflection.	Specific gravity.	Hardness.	Bent before rupture.
P. 1	Cu. 88, Sn. 10, Zn. 2	4,510	26,320	1.22	8.4269	5.06	21
P. 2	..... do	5,[illegible]	43,040	2.32	8.1449	8.33	34
N. 1	.....do	6,776	54,0[illegible]6	3.16	8.6150	5.04	50
N. 2	......do	6,[illegible]	50,000	3.53	8.5716	4.94	64
N. Y. 1.	......do	6,7[illegible]	51,000	3.30	8.3389	4.86	76
N. Y. 2.	......do	6,[illegible]	48,000	2.67	8.4691	4.36	30
Means..........		5,9[illegible]5	47,560	2.70	8.4277	4.59	

Tests by compression.

DEOXIDIZED BRONZE.

Marks.	Alloy	Applied loads.		Elastic limit.	Remarks.
		Total.	Per square inch.		
		Pounds.	*Pounds.*	*Pounds.*	
1	Cu. 88, Sn. 10, Zn. 2	60, 800	34, 140	14, 000	Failed by triple flexure.
2	do	59, 150	33, 210	16, 000	Do.
3	do	60, 920	34, 210	17, 000	Do.
Means		60, 290	33, 853	15, 666	

NAVY-YARD BRONZE.

P. 1	Cu. 88, Sn. 10, Zn. 2	34, 780	19, 610	10, 000	Failed by triple flexure.
P. 2	do	36, 700	20, 690	10, 000	Do.
N. 1	do	40, 800	23, 090	13, 000	Do.
N. 2	do	40, 300	22, 810	13, 000	Do.
N. Y. 1	do	36, 160	20, 460	10, 000	Do.
N. Y. 2	do	36, 300	20, 540	10, 000	Do.
Means		37, 506	21, 200	11, 000	

No. 10.—BUREAU OF PROVISIONS AND CLOTHING.

NAVY DEPARTMENT,
BUREAU OF PROVISIONS AND CLOTHING,
Washington, D. C., November 1, 1888.

SIR: I have the honor to submit the Bureau's report for the fiscal year 1888, including recommendations for your consideration, accompanied by appendices, as follows:

(A) Organization of Bureau and summaries of office work for the year.
(B) Estimates of appropriations required by the Bureau for year ending June 30, 1890.
(C) Form of quarterly balance-sheet of naval stores and material rendered from every station and ship.
(D) Statement of appropriation "Provisions" for fiscal year 1888.
(E) Statement of appropriation "Contingent, Provisions and Clothing" for fiscal year 1888.
(F) Statement of Clothing Fund for fiscal year 1888.
(G) Statement of Small Stores Fund for fiscal year 1888.
(H) Statement of sales at auction during fiscal year 1888.
(I) Schedules of proposals to furnish naval supplies invited under advertisements.
(K) Schedule of contracts made during fiscal year 1888.

PURCHASE OF GENERAL SUPPLIES FOR THE NAVY, ETC.

An important feature of the consolidation under the cognizance of this Bureau of all general supplies for the Navy is the purchase under its supervision of all those that are obtained, as directed by law, by contract after advertisement or at open purchase.

A large mass of work has thus devolved upon this Bureau, including heavy responsibilities. The experience gained has been very valuable, and gives warrant for conducting the work of this nature for the coming year with improved methods and with very satisfactory results.

Among the tables in Appendix A to this report will be found some that illustrate the volume of business in the Bureau in the matters of requisitions acted upon and contracts made.

INSPECTION OF SUPPLIES.

Under the reorganized system, boards of inspection render service of great value to the Government. All supplies submitted for delivery under contract or by open purchase must be carefully inspected, and tested when necessary, by a board of three officers, who are entirely independent of the purchasing agent and of the storekeeper who is to receive the supplies for issue; and nothing can be accepted without the unanimous approval of the board. This method of inspection is so widely different from that formerly in use that most encouraging results have been achieved. A marked improvement is reported in the quality of supplies delivered, and still further benefits may be expected with greater experience. As the importance of the work of inspection boards

is demonstrated it becomes evident that at the larger stations they should have improved means for successfully discharging their duties. Facilities for chemical analysis and protracted practical trials should be at their command, according to the usage of great business establishments. Most useful experimental tests would thus be available prior to purchase in large quantities, and the Government would be enabled to avoid buying supplies of an unsuitable quality or character.

The present duties of boards of inspection are very exacting and attended by great responsibilities. A complete record of all their acts must be kept, showing articles inspected, dates of inspection, and the results, stating causes if rejected; and reports of inspections must be made in duplicate to the commandant of the station. It will readily be understood that the inspection of supplies of infinite variety and involving hundreds of thousands of dollars in value is attended with great labor.

The Bureau recommends, therefore, that at the more important stations boards of inspection should be provided with suitable office quarters and conveniences, and that a clerk should be allowed for the proper performance of the extensive clerical work required.

PROPERTY ACCOUNTS.

Important progress has been made during the year in improving and simplifying the system of property accounts ashore and afloat.

While the main features of the original plan have been preserved, an entirely new system of books and returns has been devised, which, it is believed, will yield valuable results.

A careful classification has been made of all the stores and supplies in use in the Navy, which are arranged in seventy-one classes. These are the foundation of the present system of property accounts.

Complete record of all receipts and expenditures of stores is secured, the books being kept so that expenditures "for use"—*i. e.*, for final consumption—by transfer, or by condemnation, are separately shown. Balance-sheets showing in condensed form the aggregate receipts, expenditures, and balances remaining on hand under each class will be rendered quarterly, accompanied by vouchers for purposes of audit. By way of illustration, the blank form of balance-sheets devised for this purpose is appended, marked C. The returns made on these sheets will be epitomized in the Bureau; and for the first time in the history of the Navy it will be possible at the end of the fiscal year to make a comprehensive exhibit, by classes, of receipts and expenditures of supplies throughout the entire Service, and of the total valuation of supplies on hand for issue at all shore stations.

TOBACCO.

I recommend that Congress be requested to repeal the act approved March 3, 1881, entitled "An act to regulate the mode of purchasing tobacco for the United States Navy," and that tobacco be purchased as formerly prescribed by section 3721 Revised Statutes.

Under the act of March 3, 1881, all purchases of tobacco must be made at a time arbitrarily fixed by the act, without regard to the needs of the Service. It requires separate and very costly advertising, which has averaged for the last three years more than $500 per annum; whereas if advertisements could have been published in accordance with the law governing other contracts, five-sixths of this yearly expense might have been saved. The act is vague in requiring that "the lowest bid shall be accepted for furnishing tobacco equal to the United States Navy

standard" in use at the time of the passage of the act. As there was then no positive or well-defined standard in existence, the natural effect of competition under the law is to lower the quality.

The tobacco bought for the Navy and afterward sold to the enlisted men should be suited to their taste, and should also be manufactured with such regard to process and admixture as to withstand trying changes of climate. A month of damp tropical weather might utterly spoil tobacco that in a temperate climate would be of satisfactory quality. But the present law recognizes no principle of selection save that of competition with reference to a non-existent standard; and the Bureau, therefore, recommends its repeal, as being not so well calculated to secure satisfactory results as the former law.

ADVERTISING FOR GENERAL SUPPLIES.

I recommend also that Congress be requested to consider the propriety of modifying the existing law as to advertising for supplies for the Navy to be furnished by contract.

The present law (section 3718 Revised Statutes), which requires advertisement once a week for at least four weeks, was undoubtedly well suited to the time of its enactment, in 1843, when the mails were slow and the telegraph was not a factor in the transaction of business; but since that time the world's commercial methods have been revolutionized, and it is manifest that advertising for two weeks would now secure greater currency in business circles than could have been attained forty years ago in twice that length of time. In the interest of economy and quicker delivery of supplies, I respectfully suggest, therefore, that the limit of advertising be reduced to two weeks, in the discretion of the Secretary of the Navy.

PAY-OFFICERS' BONDS.

Since the recommendations in reference to disbursing officers' bonds, contained in the Bureau's last annual report, the Department has submitted to the Attorney-General for his opinion the question of its power to approve a pay-officer's bond in which the sureties are corporations created by State authority, or in which one or more such corporations may be joined as surety or sureties with a natural person.

The following is an extract from the opinion of the Acting Attorney General, dated August 2, 1888:

> Section 1383 Revised Statutes requires that a pay-officer shall, before entering on the duties of his office, give bond, with two or more sufficient sureties, to be approved by the Secretary of the Navy, for the faithful performance thereof.
>
> I see no reason why you should not approve a pay-officer's bond having corporations solely or in combination with natural persons as sureties. The question of the surety's sufficiency is, under the law, for you alone to determine; and where a corporation is tendered as surety that question involves the further question for your determination, whether such corporation has the power under its charter to enter into the obligation. It is the sufficiency of the sureties that the law looks to, and it does not concern itself any further.

In view of this opinion, and of the fact that section 2 of the act approved August 8, 1888, fixes a limitation of time within which suits shall be brought against sureties upon bonds, the Bureau deems it unnecessary to renew its recommendations submitted in a former report on this subject.

I have the honor to be, very respectfully, your obedient servant,

JAMES FULTON,
Paymaster General U. S. Navy.

Hon. W. C. WHITNEY,
Secretary of the Navy.

APPENDIX A.

ORGANIZATION OF BUREAU, AND TABLES SUMMARIZING VOLUME OF OFFICE WORK FOR THE FISCAL YEAR ENDING JUNE 30, 1888.

DIVISION OF ACCOUNTS AND AUDIT.

Pay Inspector A. S. Kenny, U. S. N., in charge.

Subdivision A.—Receives bills for all purchases authorized by the Paymaster General for the several bureaus of the Navy Department, verifies the same and approves them for payment; keeps a permanent record-book of all payments, files and indexes the triplicate vouchers; keeps journal and ledger accounts of all money requisitions issued, a record-book of all contracts, and a record-book of purchases; receives, records, indexes, and transmits for payment Fourth Auditor's certificates.

Statement of expenditures under cognizance of Bureau of Provisions and Clothing for fiscal year.

Pertaining to Bureaus of—	Number of money requisitions drawn by Bureau.	Number of vouchers approved and paid.	Amounts.
Construction and Repair	432	1,183	$1,265,116.63
Yards and Docks	464	1,349	1,129,043.94
Ordnance	415	1,610	877,737.77
Provisions and Clothing	433	1,325	721,293.65
Steam Engineering	334	848	602,094.99
Equipment and Recruiting	403	1,273	416,577.91
Navigation	231	633	75,589.79
Naval Academy	65	277	41,520.69
Medicine and Surgery	20	26	14,373.30
Total	2,797	8,474	5,143,348.76

Summarized statement of Fourth Auditor's certificates recorded and forwarded for payment, fiscal year 1888.

Month.	Number.	Amount.
1887.		
July	142	$10,687.99
August	155	17,416.86
September	131	15,551.40
October	133	12,722.21
November	169	12,243.08
December	190	15,156.17
1888.		
January	184	27,132.97
February	203	44,323.07
March	217	73,753.90
April	132	44,299.70
May	285	61,224.40
June	339	166,034.35
Total	2,280	506,576.70

Subdivision B.—Is charged with the examination and audit of the quarterly returns of the general storekeepers at the several navy-yards, stations, and store-ships; verifies the accompanying vouchers of receipts and expenditures; examines and files monthly money statements and exhibits and statements of payments by the purchasing pay officers and paymasters of the several navy-yards and stations, and causes the proper adjustments by transfer of money; keeps a journal and ledger account with each pay officer in the Navy, and conducts correspondence pertaining to the proper dispatch of the work of the division.

Summary.

Designation of returns, etc.	Number received and audited.	Amount.
Quarterly returns	108	$3,[illegible]
Money statements	240	12,[illegible]
Transfers between bureaus	1,500	[illegible]
Exhibits and statements of payments	242	721,293
Invoices, vouchers, etc	2,348	2,526,824

Subdivision C.—Examines and audits paymasters' monthly reports (summary statements), quarterly accounts-current, quarterly and final returns of receipts and expenditures, the invoices and vouchers accompanying the same, on board ships U. S. Navy, Coast Survey, and Fish Commission, under cognizance of all the bureaus of the Navy Department, excepting Medicine and Surgery; reports the settlement of pay officers' accounts, transfers, balances, checkages, etc., to the Fourth Auditor of the Treasury; refers pay officers' weekly and monthly statements of public funds to the Treasurer of the United States for verification, records and files the same, and attends to the correspondence incident to the work of the division.

Summary.

Designation of reports, etc.	Number received, examined, etc.	Amount.
Summary statements	600	$5,241,001.18
Accounts current	200	5,241,001.18
Quarterly returns	1,400	5,241,001.18
Invoices, vouchers, etc	17,450	5,241,001.18
Returns abstracted	200	5,241,001.18
Statement of public funds (weekly)	3,000	535,834.00
Statement of public funds (monthly)	600	535,834.00

DIVISION OF PURCHASE AND SUPPLIES.

Paymaster H. T. Stancliff, U. S. N., in charge.

Subdivision A.—Receives and enters in permanent record-books requisitions for supplies and services, forwards the same to the chiefs of the several Bureaus for approval, modification, or disapproval, and on their return to the bureau prepares and submits them for the action of the Paymaster-General; and finally transmits the approved requisitions to the purchasing pay officers for open purchase, or advertises for the supplies or services called for therein. This subdivision also prepares blank schedules of public stores at the different yards and stations under the cognizance of the several bureaus, which, when filled out, show the value and quantity of stores on hand, the purpose being to obviate the purchase of material found to be on hand and available. It is also charged with procuring and distributing blanks, directs the shipment of stores to foreign stations, and conducts the correspondence relating to the purchase, care, and handling of naval supplies.

Summary of requisitions acted on during fiscal year.

Yards and stations.	Bureaus.							Total.
	Yards and Docks.	Equipment and Recruiting.	Navigation.	Ordnance.	Construction and Repair.	Steam Engineering.	Provisions and Clothing.	
Portsmouth	23	47	20	22	75	92	24	303
Boston	102	352	24	23	27	26	48	602
Training Station		117	17	8	48	8	8	206
Torpedo Station				265			16	281
New London	25	3	1		4	8	3	44
New York	103	431	81	187	488	211	355	1,856
League Island	22	34	10	9	42	9	32	158
Washington	84	64	27	428	66	21	116	806
Annapolis		17	6	99	10	10	17	159
Norfolk	53	110	26	59	94	49	62	453
Port Royal	5	6			2	3		16
Key West	11	5	1		1	7	4	29
Pensacola	7	5			2	4	9	27
Mare Island	55	75	13	6	38	34	57	278
Sackett's Harbor	1							1
Miscellaneous		110	40	60	77	31	108	126
Naval Academy								234
Naval Asylum								420
Bureau orders								85
Total	491	1,376	266	1,166	974	513	850	6,084

Subdivision B.—Prepares and supplies the blanks for the information and use of bureau representatives at the yards and stations in making estimates for annual supplies; prepares and furnishes on application blank forms of proposal; prepares advertisements and specifications; opens bids; prepares contracts after awards, furnishing the several copies required for the United States Returns Office, bureaus of the Navy Department, yards and stations, and contractors; prepares schedules of stationery for the entire Service and Department, and contracts therefor; supplies general storekeepers with information showing distribution among the several bureaus of stores to be delivered under annual contracts, and conducts the correspondence relating thereto.

Summary.

Designation of work.	Number.	Amount.
Proposals prepared and mailed	603	$1,165,688.24
Contracts prepared and executed	255	
Advertisements prepared	57	
Copies of contracts made out for general storekeepers, contractors, and Bureau use	1,020	

DIVISION OF CORRESPONDENCE AND FILES.

Chief Clerk Louis E. Beall in charge.

Has the immediate charge of the Bureau's correspondence, keying, indexing, press-copying, and recording letters sent, and keying, indexing, and distributing letters received, and all returns, reports, requisitions, bills, invoices, etc.; has charge of circulars, blank forms, blank books, etc., and of their distribution; issues stationery; and keeps a permanent record of the daily attendance and service of the civilian employés of the Bureau.

Summary.

Number of letters received during fiscal year	9,960
Number of letters written during fiscal year	10,500
Number of packages (blanks, reports, forms, etc.) sent to naval officers during fiscal year	1;350
Number of letters recorded (copied in permanent record-books with pen and ink)	10,500

APPENDIX B.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1890, by the Bureau of Provisions and Clothing, Navy Department.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Total amount to be appropriated under each head of appropriation.	Amount appropriated for the current fiscal year ending June 30, 1889.
SALARIES.			
One chief clerk (act of July 11, 1888)	$1,800.00		
One clerk of class four (same act)	1,800.00		
Three clerks of class three, at $1,600 each (same act)	4,800.00		
Four clerks of class two, at $1,400 each (same act)	5,600.00		
Nine clerks of class one, at $1,200 each (same act)	10,800.00		
One stenographer (same act)	1,400.00		
One clerk (same act)	1,000.00		
Two copyists, at $900 each (same act)	1,800.00		
One assistant messenger (same act)	720.00		
One laborer (same act)	660.00		
One laborer (submitted)	660.00		
		$31,040.00	$30,380.00
PROVISIONS.			
Provisions and commutations of rations for 8,250 men and boys and 1,000 marines, 3,376.250 rations, at 30 cents each (R. S., p. 733, secs. 3709, 3747; act May 12, 1879, vol. 21, p. 3; act September 7, 1888)	1,012,875.00		
Commutation of rations for 287 naval cadets and 726 officers on sea duty, 369,745 rations, at 30 cents each (same acts)	110,923.50		
Water for drinking and cooking purposes aboard ships (same acts)	11,000.00		
Labor and expenses of general store-houses (same acts)	90,000.00		
		1,224,798.50	1,066,000.00
CONTINGENT.			
Freight on shipments; candles, fuel, books and blanks, stationery, advertising; furniture for general store-houses (formerly designated as inspections of provisions and clothing) and pay officers in navy-yards; expenses of Naval Clothing Factory, and machinery for same; foreign postage, telegrams, telephones, express charges, tolls, ferriage, yeoman's stores, iron safes, newspapers, ice, and other necessary incidental expenses (act of September 7, 1888)	....	40,000.00	30,000.00
CIVIL ESTABLISHMENT.			
Navy-yard at Portsmouth, N. H.			
In general store-house:			
Two book-keepers at $1,200 per annum each (act of January 30, 1885, vol. 23, p. 295, sec. 3; act September 7, 1888)	2,400		
One assistant book-keeper (same acts)	720		
One bill clerk (same acts)	1,000		
One assistant clerk (same acts)	720		
One shipping and receiving clerk (same acts)	1,000		
In pay office:			
One messenger, at $2 per diem (submitted)	626		
Navy-yard, Boston, Mass.			
In general store-house:			
One book-keeper (same acts as above)	1,017.25		
One shipping clerk (same acts)	939		
One receiving clerk (same acts)	939		
In pay office:			
One writer (same acts)	1,017.25		
One messenger at $2 per diem (submitted)	626.00		
Navy-yard, Mare Island, Cal.			
In general store-house:			
Two book-keepers, at $1,200 per annum each (same acts as above)	2,400.00		
Two assistant book-keepers, at $720 each per annum (same acts)	1,440.00		
One receiving clerk (same acts)	1,000.00		
One shipping clerk (same acts)	1,000.00		
One bill clerk (same acts)	1,000.00		
One assistant clerk (same acts)	1,000.00		
In pay office:			
One writer (same acts)	1,017.25		
One messenger, at $2 per diem (submitted)	626.00		

Estimates of appropriations requirdd for the service of the fiscal year, etc.—Continued.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Total amount to be appropriated under each head of appropriation.	Amount appropriated for the current fiscal year ending June 30, 1889.
CIVIL ESTABLISHMENT—continued.			
Navy-yard, New York, N. Y.			
In general store-house:			
Three book-keepers, at $1,200 per annum each (same acts as above)	$3,600.00		
One assistant book-keeper (same acts)	1,000.00		
One assistant book-keeper (same acts)	720.00		
Three receiving clerks, at $4 per diem each (same acts)	3,756.00		
One assistant receiving clerk (same acts)	1,099.00		
Three shipping clerks, at $1,000 per annum each (same acts)	3,000		
One bill clerk (same acts)	1,000		
One assistant bill clerk (same acts)	720		
Two leading men, at $2.50 per diem each (same acts)	1,565.00		
Five pressmen, at $2.76 per diem each (same acts)	4,319.40		
One superintendent coffee-mills, at $3 per diem (same acts)	939.00		
One box-maker, at $3 per diem (same acts)	939.00		
One engine-tender, at $3.26 per diem (same acts)	1,020.38		
One coffee-roaster, at $2.50 per diem (same acts)	782.50		
One fireman, at $2 per diem (same acts)	626.00		
One messemger, at $2 per diem (same acts)	626.00		
In pay office:			
One writer (same acts)	1,017.25		
One messenger, at $2 per diem (same acts)	626.00		
Navy-yard, League Island, Pa.			
In general store-house:			
One book-keeper (same acts)	1,200.00		
One assistant book-keeper (same acts)	720.00		
In pay office:			
One messenger, at $2 per diem (submitted)	626.00		
Navy-yard, Washington, D. C.			
In general store-house:			
One book-keeper (same acts as above)	1,200.00		
One clerk (same acts)	1,200.00		
One receiving clerk (same acts)	1,000.00		
One bill clerk (same acts)	1,000.00		
One shipping clerk (same acts)	1,000.00		
In pay office:			
One writer (same acts)	1,017.25		
One messenger, at $2 per diem (submitted)	626.00		
Navy-yard, Norfolk, Va.			
In general store-house:			
Two book-keepers, at $1,200 per annum each (same acts as above)	2,400.00		
Two assistant book-keepers, at $1,017.25 per annum each (same acts)	2,034.50		
One bill clerk (same acts)	1,000.00		
One assistant bill clerk (same acts)	720.00		
One receiving clerk (same acts)	942.00		
One assistant receiving clerk (same acts)	720.00		
In pay office:			
One writer (same acts)	1,017.25		
One messenger, at $2 per diem (submitted)	626.00		
Naval Academy, Annapolis, Md.			
In general store-house:			
One book-keeper (same acts as above)	1,017.25		
One receiving and shipping clerk (same acts)	1,000.00		
In pay office:			
One messenger at $2 per diem (submitted)	626.00		
Torpedo station, Newport, R. I.			
In general store-house:			
One clerk (same acts as above)	1,200.00		
In pay office:			
One messenger, at $2 per diem (submitted)	626.00	$71,361.53	$66,666.53

APPENDIX C.

BUREAU OF ——— ———.

Balance-sheet of naval stores and material, ——— ——— U. S. ———, for ——— ending ———, 18—.

Class No.	Ledger accounts.	Balance on hand by last return.	Received since last return.	Expended. For use.	Expended. Condemn'd.	Expended. Transferred.	Expended. Total issues.	Balance remaining on hand.
1	Ammunition and explosives							
2	Anchors and anchor-gear							
3	Apparatus and material, electric							
4	" " " fire							
5	" " " photographic							
6	Arms, small, and accoutrements							
7	Articles of canvas							
8	Bags, boxes, and chests							
9	Blocks, etc							
10	Bolts							
11	Brushes and brooms							
12	Buckets, hods, and shovels							
13	Building material							
14	Canvas							
15	Chain and articles of chain							
16	Clothing							
17	Cocks, gauges, valves, etc							
18	Cordage, cables, hawsers, and miscellaneous rigging							
19	Dry goods							
20	Fuel							
21	Furniture and fittings, galley, kitchen, house, and table							
22	Glass							
23	Guns and carriages							
24	Gun equipment and implements							
25	Hardware							
26	Hose							
27	Incidentals							
28	Instruments and apparatus, navigation							
29	Instruments and apparatus, musical							
30	Instruments and apparatus, miscellaneous							
31	Lamps and lamp fixtures							
32	Leather and belting							
33	Lumber and timber, ash and poplar							
34	" " " oak							
35	" " " white pine							
36	" " " yellow pine							
37	" " " miscellaneous							
38	Machinery and machine tools							
39	Metals, brass, copper, lead, tin, zinc, etc							
40	Metals, iron bar							
41	Metals, iron, sheet							
42	" " miscellaneous							
43	" steel, bar							
44	" " sheet, plate, spring							
45	Metals, scrap brass, copper, lead, steel, zinc, etc							
46	Metals, scrap iron							
47	Nails, spikes, etc							
48	Naval stores							
49	Nuts, square, hexagon, etc							
50	Oils, illuminating and lubricating, and grease							
51	Packing and rubber							
52	Paints, varnishes, chemicals, drugs, etc							
53	Pipe and fittings							
54	Provisions							
55	Pyrotechnic signals, flags, etc							
56	Rivets, lag-screws, and washers							
57	Rolling stock							
58	Screws, brass, iron, steel, etc							
59	Ship and boat equipment and fittings							
60	Small stores							
61	Stationery, books, and blanks							

$705, 052. 47

317, 306. 30

1, 581, 184. 76

, 1888.

95. 87

329. 42 $235, 425. 29

62, 307. 19

60, 459. 54

53, 839. 61

57, 877. 10

1, 968. 14

576. 00

60, 459. 54

APPENDIX

4, 489. 00

.36

111, 107. 71

125, 386. 13

APPENDIX E.

Statement of appropriation "Contingent, Provisions and Clothing," for fiscal year ending June 30, 1888.

To appropriation for fiscal year ending June 30, 1888....	$50,000.00	
To amount refunded by transfer from other bureaus....	5,861.69	
		$55,861.69
By amount expended for contingent stores purchased by Bureau	8,279.78	
By amount expended for contingent stores purchased by pay officers of ships	2,587.44	
		10,867.22
By amount paid for freight and express	13,240.24	
By amount paid for advertising and newspapers	4,543.95	
By amount paid for books, blanks, and stationery (Naval establishment)	12,781.33	
By amount paid for postage, telegrams, tolls, and ferriage	2,664.66	
By amount paid for furniture and fuel at inspections...	4,991.50	
By amount paid for yeomans' stores, iron safes, and for incidentals	4,907.98	
		43,129.66
		53,996.88
By balance of appropriation unexpended, subject to future adjustment		1,864.81
		55,861.69

APPENDIX F.

Statement of Clothing Fund for fiscal year ending June 30, 1888.

To cash balance to credit of Clothing Fund June 30, 1887.	$313,873.01	
To unadjusted balances due Clothing Fund June 30, 1887.	45,807.60	
		$359,680.61
To amount of issues, sales, and transfers during fiscal year		243,977.47
To valuation of clothing in store and in transit June 30, 1887	477,420.36	
To valuation of clothing on board ships June 30, 1887..	208,956.22	
		686,376.58
To cost of clothing manufactured and purchased by Bureau during fiscal year	288,594.10	
To cost of clothing purchased by pay officers of ships during fiscal year	2,556.00	
		291,150.10
		1,581,184.76
By cash paid for clothing manufactured and purchased during the fiscal year		276,032.99
By valuation of clothing issued to officers, crew, and marines during fiscal year	$222,295.00	
By valuation of clothing sold for cash	3,175.00	
By valuation of clothing transferred to other bureaus..	450.00	
By net proceeds of sales of condemned clothing	18,057.47	
		243,977.47
By amount of loss on sales of condemned clothing	37,065.53	
By amount of loss on issues to officers, crew, and marines	1,450.00	
By amount of loss on account of reduction in price through deterioration	300.00	
		38,815.53

By valuation of clothing in store and in transit June 30, 1888	$467,190.11	
By valuation of clothing on board ships June 30, 1888	237,862.36	
		$705,052.47
By cash balance to credit of Clothing Fund June 30, 1888	191,319.07	
By cash balance due, subject to adjustment, June 30, 1888	125,987.23	
		317,306.30
		1,581,184.76

APPENDIX G.

Statement of Small Stores Fund for fiscal year ending June 30, 1888.

To cash balance to credit of Small Stores Fund, June 30, 1887	$103,592.01		
To unadjusted balances due Fund June 30, 1887	14,503.86		
		$118,095.87	
To valuation of small stores in store and in transit June 30, 1887	75,531.90		
To valuation of small stores on board ships June 30, 1887	41,797.52		
		117,329.42	
			$235,425.29
To cost of small stores purchased by the Bureau during fiscal year		57,842.26	
To cost of small stores purchased by pay officers of ships		4,554.93	
			62,397.19
To amounts received from issues, sales, and transfers			60,459.54
			358,282.02
By cash expended for small stores purchased during fiscal year			53,839.61
By valuation of small stores issued to officers, crew, and marines during year		57,877.10	
By valuation of small stores issued to other bureaus, refunded		1,968.44	
By cash received from sales at auction of condemned small stores		576.00	
By cash received from other sales		38.00	
			60,459.54
By loss on sales of condemned small stores		3,150.00	
By loss on stores condemned as worthless		750.00	
By net loss on issues on board ships		589.00	
			4,489.00
By valuation of small stores in store and in transit June 30, 1888	76,123.38		
By valuation of small stores on board ships June 30, 1888	37,984.36		
		114,107.74	
By cash balance to credit of Fund June 30, 1888	88,515.62		
By cash balance due June 30, 1888, subject to adjustment	36,870.51		
		125,386.13	
			239,493.87
			358,282.02

APPENDIX H.

Statement of sales at navy-yards and stations of condemned materials pertaining to the Bureau of Provisions and Clothing during the fiscal year ending June 30, 1888.

Where sold.	To whom sold.	Gross proceeds provisions.	Gross proceeds contingent.	Net proceeds provisions and contingent.	Gross proceeds clothing.	Net proceeds clothing.	Gross proceeds small stores.	Net proceeds small stores.	Cost of sale.
Portsmouth..	Russell, Cott, Hallett, Fitzgerald, Langdon, Smith, Lunt, Quinn, Stoddard & Son, Dreyfus, Simmons & Co., Allen, Henderson, Stoddard & Bro., Abrams, Bannerman & Supple.	$368.97	$44.00	$406.78	$5,499.66	$5,417.00	$62.50	$61.56	$89.79
Boston.......	Golding, Ryder & Cotton, Howe, Dreyfus, Murray, Norton Bros., Mullany.	......	......	......	2,495.81	2,450.07	......	......	45.74
New York...	Abbey, Merrigan, McMahon, Harris, Stoddard, Bosthwick, Conover.	79.00	59.00	132.36	9,601.00	9,208.29	448.45	430.11	416.69
Washington .	Bannerman, Dreyfus, Bradbury, Lackey, Bartlett, Sugenheimer, Baum, Simpson.	20.95	1.10	21.51	807.77	788.50	56.68	55.33	21.18
Mare Island .	Connolly, Powell, Carman, Pasalaqua, Ford, Kehoe, Aden, Deering, Hirch, Supple, Rob.	397.65	2.30	361.95	442.15	431.10	8.10	7.89	49.26
	Totals............	866.57	106.40	922.60	18,836.39	18,294.96	575.73	554.89	622.64

APPENDIX I.

Schedule of proposals for supplies for navy-yard, New York, received by Bureau of Provisions and Clothing, under advertisement dated July 1, 1887

Class A.—Electric apparatus:	
James J. Donovan*	$141.00
Peter H. McNulty	159.90
Class A.—Fire apparatus, hose, etc.:	
Gutta-percha Rubber Manufacturing Company	2,522.00
James J. Donovan	2,822.00
Garcin, Moseley & Boehmert†	2,104.40
American Fire Hose Manufacturing Company	3,373.25
Edgerton Bynner	2,756.12
Peter H. McNulty*	2,476.00
Rowland A. Robbins	2,621.00
Class B.—Brushes:	
James J. Donovan	1,073.02
William R. Thompson	1,185.18
George L. Neville	1,055.77
Rowland A. Robbins*	719.33
Class B.—Building materials:	
James J. Donovan	4,378.40
Sweeny Brothers	4,761.70
E. B. Hosier†	2,970.00
Rowland A. Robbins*	2,983.71

* Contract awarded. † No guaranty or certificate or otherwise informal.

Class C.—Canvas:	
Rowland A. Robbins*	$222.62
Class C.—Chemicals and drugs:	
James J. Donovan	11,477.39
E. B. Hosier †	3,879.00
Rowland A. Robbins*	11,430.46
Class D.—Dry goods:	
James J. Donovan	1,267.70
Peter H. McNulty	1,811.44
Rowland A. Robbins*	1,742.50
Class E.—Equipment and fittings, ship and boat:	
Rowland A. Robbins*	319.78
Class F.—Fittings, boiler, etc.:	
James J. Donovan	7,604.95
Rowland A. Robbins*	7,081.10
Class F, 1.—Fuel:	
David S. Wells	30,450.56
David Duncan & Son*	30,266.04
Class F, 2.—Fuel:	
David Duncan & Son*	5,870.00
Class F, 3.—Fuel:	
John J. McConnell†	544.51
James J. Donovan*	792.48
Samuel G. French	1,104.00
Rowland A. Robbins	830.92
Class F, 4.—Fuel:	
James J. Donovan*	580.00
Samuel G. French	592.00
Peter H. McNulty	676.00
Rowland A. Robbins	672.00
Class F.—Furniture, galley and kitchen:	
F. T. Witte Hardware Company	406.07
Rowland A. Robbins*	323.85
Class F.—Furniture, house:	
William R. Thompson	4,410.77
Peter H. McNulty*	3,101.51
Rowland A. Robbins	3,981.31
Class F.—Furniture, table:	
Rowland A. Robbins*	152.00
Class I.—Mathematical instruments:	
Rowland A. Robbins*	255.39
Class L.—Lamps and lanterns:	
Romer & Co‡	137.50
William Porter's Sons*	2,027.12
Rowland A. Robbins	2,117.06
Class L.—Leather, rubber, etc.:	
James J. Donovan	3,527.29
Garcin, Moseley & Boehmer	3,516.65
Stevenson Bros. & Co	3,805.15
Rowland A. Robbins*	3,207.56
Class L.—Lumber:	
Lewis N. Ross ‡	21,215.25
James J. Donovan‡	4,590.00
South Brooklyn Saw-mill Company	2[illegible],137.50
Watson & Pettinger‡	4[illegible],567.00
Joseph W. Duryee*	37,184.50
C. F. Hodson‡	972.00
I. T. Williams‡	2[illegible],[illegible]80.00
Ettinger & Russell‡	9,[illegible]00.00
Class M.—Machinery and machine tools:	
S. C. Forsaith Machine Company	4,[illegible]95.10
James J. Donovan	4,727.95
Rowland A. Robbins*	4,087.24
Class M.—Metals:	
James J. Donovan	17,578.84
John Moonan‡	748.25
New York Smelting and Refining Company ‡	2,546.50
Rowland A. Robbins*	16,335.63

* Contract awarded.
† No guaranty or certificate or otherwise informal.
‡ No bid for fuel class.

Class N.—Naval stores:	
James J. Donovan	$1,207.50
George L. Neville	1,464.00
Rowland A. Robbins*	1,182.50
Class O.—Oils, etc.:	
Brooks Oil Company	16,837.39
Reed, Hall & Hewlett*	16,197.27
New York Refining Company	48,2[illegible].50
James J. Donovan	16,656.50
Thomas A. McElwell †	1,950.00
William T. Cole & Co†	405.00
Buckston, Hines & Co†	27.77
Manhattan Oil Company	16,530.20
Stevenson Bros. & Co	19,849.25
Rowland A. Robbins	18,483.1[illegible]
Class P.—Pipe, steam, gas and water:	
James J. Donovan	8,763.20
New York Smelting and Refining Company‡	476.00
Rowland A. Robbins*	9,369.96
Class P.—Provisions:	
James J. Donovan	172.58
Williams & Rickerson	140.92
E. B. Hosier*	97.09
Rowland A. Robbins	165.70
Class S.—Ship chandlery:	
James J. Donovan	1,086.00
George L. Neville	4,984.65
Rowland A. Robbins*	4,148.43
Class S.—Small stores:	
William R. Thompson*	348.72
E. B. Hosier †	49.69
Rowland A. Robbins	367.41
Class S.—Engineers' supplies:	
James J. Donovan	7,328.53
Albert Flagler†	487.57
Rowland A. Robbins*	6,523.82
Class S.—Plumbers' supplies:	
Rowland A. Robbins*	933.05
Class T.—Tools and hardware:	
James J. Donovan	13,550.29
Romer & Co †	266.25
Albert Flagler †	8,538.29
Rowland A. Robbins*	12,043.31
Class W.—Wood and willow ware:	
William R. Thompson*	452.35
Rowland A. Robbins	487.90
No. 1, Miscellaneous, provender:	
John Moonan*	2,346.00
Ed. A. Shipman	2,669.60
Williams & Rickerson	2,369.50
Rowland A. Robbins	3,133.09
No. 3.—Miscellaneous, sundries:	
E. B. Hosier	171.09
Rowland A. Robbins*	155.80

Schedule of proposals for supplies for navy-yard, Norfolk, Va., received by Bureau of Provisions and Clothing, under advertisement dated July 1, 1887.

Class A.—Electric apparatus:	
George L. Neville*	$8.82
Class A.—Fire apparatus, hose:	
Gutta-percha and Rubber Manufacturing Company*	2,799.20
Garcin, Moseley & Boehmert	2,580.80
American Fire Hose Manufacturing Company	3,894.80
Reuter & Mallory‡	3,9[illegible]9.50
Mayer & Co	2,937.00
E. V. White & Co	3,118.55
Melville Lindsay‡	2,938.00
Rowland A. Robbins	3,017.80

* Contract awarded. † No bid for fuel class. ‡ Informal.

Class B.—Brushes:	
William A. Thompson	$1,101.10
Mayer & Co	1,307.65
George L. Neville	937.02
E. J. Griffith & Co	1,044.34
Rowland A. Robbins*	750.73
Class B.—Building material:	
A. A. McCullough*	4,123.80
Mayer & Co	5,282.85
George L. Neville	5,247.33
Class C.—Chemicals and drugs:	
W. B. Price Manufacturing Company*	6,155.55
Mayer & Co	7,753.80
Lawrence & Co	6,554.15
George L. Neville	7,136.09
Class C.—Cordage:	
Mayer & Co	35.00
George L. Neville*	30.00
E. V. White & Co	40.00
Rowland A. Robbins	48.00
Class D.—Dry goods:	
Umstadter & Myers	353.10
Mayer & Co	605.10
George L. Neville*	334.95
Rowland A. Robbins	341.61
Class F.—Boiler fittings:	
E. V. White & Co.*	407.57
Class F, 1.—Fuel:	
A. A. McCullough*	2,296.75
W. & J. Parker	2,353.60
David S. Wells	2,858.50
David Duncan & Son	2,826.96
Class F, 2.—Fuel:	
A. A. McCullough	5,120.00
George W. Taylor & Co	4,577.50
W. & J. Parker	5,575.00
William Lamb & Co.*	4,435.00
David Duncan & Son	5,215.00
Class F, 3.—Fuel:	
A. A. McCullough	589.50
Mayer & Co	550.20
George L. Neville*	432.10
E. V. White & Co	550.20
A. H. Lindsay	589.50
Class F, 4.—Fuel:	
A. A. McCullough	122.50
J. W. Oast & Bro*	113.75
George L. Neville	122.50
A. H. Lindsay	138.25
Class F.—Furniture, galley and kitchen:	
F. T. Witte Hardware Company*	1,031.52
E. J. Griffith & Co	1,265.40
Class F.—Furniture, house:	
E. J. Griffith & Co.*	404.20
Class F.—Furniture, table:	
George L. Neville*	270.24
Class I.—Mathematical instruments:	
Mayer & Co.*	427.00
Class L.—Lamps and lanterns:	
Romer & Co.†	239.40
Mayer & Co	1,843.00
William Porter's Sons*	1,137.92
Class L.—Leather, rubber, and belting:	
Mayer & Co	1,822.25
George L. Neville*	1,813.00
Stevenson Bros. & Co.†	1,622.80
Class L.—Lumber and timber:	
A. A. McCullough	15,499.77
Joseph W. Duryee	16,897.70

* Contract awarded. † Informal.

Class L.—Lumber and timber—Continued.	
J. W. Gaskill & Sons	$20,794.45
George L. Neville*	14,576.10
Class M.—Machinery and machine tools:	
S. C. Forsaith Machine Company*	1,293.05
George L. Neville	1,497.20
Class M.—Metals:	
Mayer & Co	5,971.75
George L. Neville*	5,891.28
Rowland A. Robbins	7,177.49
Class N.—Naval stores:	
Mayer & Co	633.75
George L. Neville*	594.50
Class O.—Oils, etc:	
Brooks Oil Company	2,883.28
Reed, Hall & Hewlett*	2,758.57
Reuter & Mallory†	3,316.05
Mayer & Co	3,007.05
Manhattan Oil Company	2,820.00
George L. Neville	2,985.45
Stevenson Bros. & Co.†	3,251.00
Class P.—Gas and steam pipe:	
Reuter & Mallory†	1,728.44
Mayer & Co.*	1,795.92
George L. Neville	1,836.59
Class S.—Ship chandlery:	
George L. Neville	3,911.65
Rowland A. Robbins*	2,402.20
Class S.—Small stores:	
Mayer & Co	321.60
George L. Neville	344.52
E. V. White & Co	291.72
Rowland A. Robbins*	266.64
Class S.—Engineers' supplies:	
J. A. Emerich & Co	1,877.55
Mayer & Co	1,984.65
Rowland A. Robbins*	1,404.67
Class S.—Plumbers' supplies:	
Mayer & Co	461.80
Rowland A. Robbins*	258.50
Class T.—Tools and hardware:	
Mayer & Co†	60.00
George L. Neville	3,813.90
E. J. Griffith & Co.*	2,900.97
Class W.—Wooden and willow ware:	
William A. Thompson	536.50
Mayer & Co	819.25
George L. Neville	560.25
E. J. Griffith & Co*	533.50
Rowland A. Robbins	667.00
Miscellaneous, No. 1.—Provender:	
A. A. McCullough	1,284.25
Evans, Burwell & Tazwell*	1,125.20
A. H. Lindsay	1,137.30
Miscellaneous, No. 2.—Harness and fittings:	
Mayer & Co.*	7.50
George L. Neville	10.00
Miscellaneous, No. 3.—Matches, soap, etc:	
W. & J. Parker*	46.54
Mayer & Co	101.90
George L. Neville	61.42
Rowland A. Robbins	48.86
Special, No. 1.—Oyster shells:	
A. A. McCullough*	412.50
J. W. Oast & Bro	600.00
George L. Neville	562.50
A. H. Lindsay	600.00
Special, No. 2.—Machinery and machine tools:	
George L. Neville*	176.00

*Contract awarded. †Informal.

Special, No. 3.—Foundry-cupola and brick:	
Renter & Mallory†	$578.00
J. A. Emerich & Co.*	680.00
Special, No. 4.—Steel dies:	
George L. Neville*	150.00

Schedule of proposals for supplies for navy-yard, Boston, received by Bureau of Provisions and Clothing, under advertisement dated July 1, 1887.

Class A.—Fire apparatus and hose:	
Gutta-percha and Rubber Manufacturing Company*	$55.00
American Fire Hose Manufacturing Company	63.75
Stevenson, Brother & Co†	90.00
Class B.—Brushes:	
George L. Neville*	98.00
Class C.—Chemicals, drugs, etc.:	
W. B. Price Manufacturing Company*	382.00
Class F.—Fittings, boiler, etc.:	
George L. Neville*	76.45
Class F.—Fuel, 1;	
I. E. Lewis & Co†	1,541.90
C. A. Campbell	11,175.75
David S. Wells	11,158.60
David Duncan & Son*	11,025.90
Class F.—Fuel, 2:	
C. A. Campbell	4,120.80
David Duncan & Son*	3,858.20
Class L.—Lumber and timber:	
George A. Hammond*	1,000.50
Class M.—Metals:	
George L. Neville*	960.00
Class O.—Oils, etc.:	
Brooks Oil Company	498.82
Reed, Hall & Hewlett	517.72
Manhattan Oil Company*	489.82
Stevenson, Brother & Co†	603.60
Class S.—Engineer's supplies:	
Stevenson, Brother & Co.†	8 00
Class W.—Wood and willow ware:	
John Mullett*	14.00
Class Miscellaneous, No. 1:	
John Mullett*	1,589.60
Class Miscellaneous, No. 3:	
John Mullett*	7.80

Schedule of proposals for supplies for navy-yard, Portsmouth, N. H., received by Bureau of Provisions and Clothing, under advertisement dated July 1, 1887.

Class A.—Fire apparatus, hose, etc.:	
Gutta-percha and Rubber Manufacturing Company*	$108.26
Rider & Cotton	112.78
John Swann & Co	109.06
American Fire-hose Company	144.76
R. A. Robbins	128.50
Class B.—Brushes:	
Rider & Cotton*	193.18
George L. Neville	230.92
Class B.—Building material:	
Rider & Cotton*	765.53
Class C.—Chemicals, drugs, etc.:	
William B. Price Manufacturing Company*	1,298.03
William Ward & Son†	1,415.52
Class C.—Cordage:	
Rider & Cotton	5.00
John Swann & Co*	3.70
Class D.—Dry goods:	
Rider & Cotton*	160.70

*Contract awarded. †Informal.

Class E.—Ship and boat equipments:	
Rider & Cotton	$187.50
John Swann & Co*	145.00
Z. D. Gilman	160.00
George L. Neville	200.00
R. A. Robbins	270.00
Class F.—Boiler fittings, etc.:	
Rider & Cotton*	279.73
John Swann & Co	302.71
Class F.—House furniture:	
Rider & Cotton*	111.50
Class F.—Fuel, 1:	
David S. Wells	7,998.00
E. F. Sise & Co	9,517.00
J. Albert Walker	8,525.00
David Duncan & Son*	7,936.00
Class F.—Fuel, 2:	
E. F. Sise & Co	3,773.00
J. Albert Walker	3,150.00
David Duncan & Son*	2,744.00
Class F.—Fuel, 3:	
Rider & Cotton	224.00
John Swann & Co*	94.50
Class F.—Fuel, 4:	
Rider & Cotton	60.00
George A. Hammond	45.00
J. Albert Walker*	40.00
Class I.—Measuring instruments and apparatus, etc.:	
Rider & Cotton*	33.75
John Swann & Co	34.60
Class L.—Lamps and lanterns:	
Rider & Cotton*	42.90
Class L.—Leather, rubber, and belting:	
Rider & Cotton	1,159.20
George L. Neville*	980.00
Class L.—Lumber and timber:	
George A. Hammond	5,623.60
Joseph W. Duryee	4,696.50
J. W. Gaskell & Sons*	4,311.90
Class M.—Machinery and machine tools:	
S. C. Forsaith Machine Company*	882.60
Rider & Cotton	974.00
Class M.—Metals:	
Rider & Cotton*	2,711.11
New York Smelting and Refining Company †	857.50
Class N.—Naval stores:	
Rider & Cotton	205.50
John Swann & Co*	204.00
George L. Neville	257.50
Class O.—Oils, illuminants, and lubricants:	
Brooks Oil Company	1,662.78
Reed, Hall & Hewlett	1,616.60
Rider & Cotton	1,791.30
Buckston, Hines & Co†	30.00
Manhattan Oil Company*	1,580.28
Stevenson Brothers & Co†	1,908.80
Class P.—Pipe, steam, gas, and water:	
Rider & Cotton*	486.97
New York Smelting and Refining Company †	56.12
Class P.—Provisions:	
Rider & Cotton*	3.75
Class S.—Ship chandlery:	
Rider & Cotton	260.00
James W. Soper*	167.52
George L. Neville	200.75
Class S.—Engineer's supplies:	
Rider & Cotton	909.92
John Swann & Co*	808.50

* Contract awarded. † Informal.

Class S.—Plumber's supplies:	
Rider & Cotton*	$169.80
Class T.—Tools and hardware:	
Rider & Cotton*	1,523.70
John Swann & Co	1,541.23
Class W.—Wood and willow ware:	
Rider & Cotton*	50.75
Class Miscellaneous.—No. 1:	
George A. Hammond*	2,018.45
Elmer E. Langton†	877.50
Class Miscellaneous.—No. 2:	
Rider & Cotton*	90.50

Schedule of proposals for supplies for navy-yard, Washington, D. C., received by Bureau of Provisions and Clothing, under advertisement dated July 1, 1887.

Class B.—Brushes:	
George L. Neville*	$104.40
Daniel Shanahan	201.48
Class B.—Building material:	
George L. Neville*	506.00
Class C.—Canvas:	
George L. Neville	312.00
R. A. Robbins*	261.00
Class C.—Chemicals, drugs, etc.:	
W. B. Price Manufacturing Company*	338.65
Z. D. Gilman	406.46
Daniel Shanahan	385.65
Class C.—Cordage:	
George L. Neville*	10.00
Class D.—Dry goods:	
George L. Neville	78.00
R. A. Robbins*	54.30
Class F.—Fuel, 1:	
David S. Wells	*2,588.00
Johnson Brothers	2,344.95
David Duncan & Son	2,571.15
John Miller*	2,217.80
Class F.—Fuel, 2:	
Johnson Brothers*	1,930.11
Gilmor Meredith & Co	2,000.81
David Duncan & Son	2,311.89
John Miller	2,278.00
Class F.—Fuel, 3:	
John F. Clarke †	30.10
Johnson Brothers*	274.50
Class F.—Fuel, 4:	
Johnson Brothers*	687.12
George L. Neville	1,428.00
John Miller	714.00
Class L.—Leather, rubber and belting:	
S. C. Forsaith Machine Company	1,014.15
Garcin, Moseley & Boehmer †	982.04
George L. Neville	1,118.59
Stevenson Brothers & Co†	1,554.13
J. B. Kendall	1,024.09
R. A. Robbins*	872.61
Class L.—Lumber and timber:	
Joseph W. Duryee	7,065.47
J. W. Gaskell & Sons*	6,441.14
John Miller	7,013.46
Class M.—Machinery and machine tools:	
S. C. Forsaith Machine Company*	501.30
Class M.—Metals:	
J. B. Kendall*	5,538.64
R. A. Robbins	5,640.66

* Contract awarded. † Informal.

Class N.—Naval stores:	
Z. D. Gilman (by lot)*	$34.20
George L. Neville	36.00
R. O. Edmonston	35.10
Daniel Shanahan	36.00
R. A. Robbins	34.20
Class O.—Oils, illuminants, and lubricants:	
Brooks Oil Company*	984.05
Reed, Hall & Hewlett	1,003.16
Buckston, Hines & Co†	27.88
Manhattan Oil Company	1,001.88
Reuter & Mallory †	1,214.06
Z. D. Gilman	1,015.20
Stevenson Brothers & Co†	1,106.98
R. O. Edmonston	1,055.95
Daniel Shanahan	984.86
R. A. Robbins	1,036.28
Class P.—Pipe, steam, gas, and water:	
T. Somerville & Sons*	219.25
R. A. Robbins	408.05
Class P.—Provisions:	
R. O. Edmonston*	46.38
Class S.—Ship chandlery:	
George L. Neville	8.00
R. A. Robbins*	5.60
Class S.—Small stores:	
George L. Neville	44.20
Stevenson Brothers & Co †	33.00
R. O. Edmonston	31.68
R. A. Robbins*	29.94
Class S.—Stationery, 1:	
John Wanamaker	6,934.13
R. A. Robbins*	6,820.11
Class S.—Stationery, 2:	
John Wanamaker*	1,281.86
R. A. Robbins	1,285.49
Class S.—Stationery, 3:	
John Wanamaker*	1,351.97
Class S.—Stationery, 4:	
John Wanamaker	577.14
R. A. Robbins*	511.24
Class S.—Stationery, 5:	
John Wanamaker	6,542.26
R. A. Robbins*	6,127.82
Class S.—Engineers' supplies:	
J. A. Emerich & Co	1,753.40
J. B. Kendall*	1,566.38
R. O. Edmonston †	170.63
Class S.—Plumbers' supplies:	
T. Somerville & Sons*	98.42
Class W.—Wood and willow ware:	
George L. Neville	46.00
R. O. Edmonston*	28.00
Class Miscellaneous, No. 1.—Provender:	
Myers & Loving*	1,108.20
Class Miscellaneous, No. 3.—Matches and soap:	
R. O. Edmonston*	15.60

Schedule of proposals for supplies for navy-yard, League Island, received by Bureau of Provisions and Clothing, under advertisement dated July 1, 1887.

Class A.—Fire apparatus and hose:	
Gutta-percha Rubber and Manufacturing Company	$99.20
American Fire-hose Manufacturing Company	98.60
George L. Neville †	82.00
Stevenson Bros. & Co*	270.00
R. A. Robbins	96.90

*Contract awarded. †Informal.

Class B.—Brushes:	
Roller & Shoemaker	$69.00
Charles J. Field	79.80
George L. Neville †	67.80
Class B.—Building material:	
Paul J. Field	16.40
Roller & Shoemaker	16.50
Charles J. Field †	14.60
George L. Neville	26.00
Class C, 1.—Canvas:	
George L. Neville †	30.00
Class C, 2.—Chemicals and drugs:	
Roller & Shoemaker †	42.50
George L. Neville	63.00
Class C, 3.—Cordage:	
Charles J. Field †	3.00
George L. Neville	15.00
Class D.—Dry goods:	
George L. Neville †	60.00
Class F.—Fuel:	
David S. Wells	3,194.00
David Duncan & Son †	3,178.30
Class I.—Instruments and apparatus, mathematical and philosophical:	
Paul J. Field	8.40
Charles J. Field †	7.40
George L. Neville	12.00
R. A. Robbins	8.40
Class L, 1.—Lamps and lanterns:	
Paul J. Field †	8.75
George L. Neville	28.80
Class L, 2.—Leather, rubber, and belting:	
George L. Neville †	20.00
Class L, 3.—Lumber and timber:	
Elias Pohl †	978.00
J. W. Gaskill & Sons	1,033.80
Class O.—Oils, etc.:	
Brooks Oil Company †	95.70
Paul J. Field	106.50
Charles K. Smith & Co *	116.40
Stevenson Bros. & Co *	156.00
R. A. Robbins	115.50
Class S, 1.—Small stores:	
George L. Neville †	3.00
Class S, 2.—Engineers' supplies:	
Paul J. Field	2.50
Charles J. Field †	1.20
Stevenson Bros. & Co. *	4.50
Class S, 3.—Plumbers' supplies:	
Charles J. Field †	12.24
Class T.—Tools and hardware:	
Paul J. Field	313.10
Charles J. Field †	237.94
Class W.—Wood and willow ware:	
Paul J. Field	39.50
Charles J. Field †	13.85
George L. Neville	42.00
Miscellaneous, No. 1:	
Robert McKnight & Sons †	767.50
Paul J. Field	900.40
William Brown *	721.60

Schedule of proposals for supplies for navy-yard, Pensacola, received by Bureau of Provisions and Clothing, under advertisement dated July 1, 1887.

Class B.—Brushes:	
Jeremiah O'Neal	$60.42
McKenzie, Oerting & Co	67.80
Frederick Bauer †	53.97

* Proposal informal. † Contract awarded.

Class B.—Brushes—Continued.	
Avery & Woolfolk	$09.19
Henry Horster & Co	90.85
R. A. Robbins	107.95
Class C.—Chemicals and drugs:	
Jeremiah O'Neal	605.07
McKenzie, Oerting & Company	595.55¼
Frederick Bauer	546.22
Wm. B. Price Manufacturing Company †	541.66
Avery & Woolfolk	594.75
Henry Horster & Co	661.70
R. A. Robbins	654.26
Class D.—Dry goods:	
Jeremiah O'Neal	29.20
McKenzie, Oerting & Co†	20.60
Avery & Woolfolk	44.10
R. A. Robbins	33.20
Class F.—Fittings, boiler and engine:	
Jeremiah O'Neal†	80.00
McKenzie, Oerting & Co	116.35
Frederick Bauer	118.25
Avery & Woolfolk	104.90
R. A. Robbins	194.93
Class L.—Lamps and lanterns:	
Jeremiah O'Neal	46.30
McKenzie, Oerting & Co†	38.70
Avery & Woolfolk	43.70
Henry Horster & Co	79.00
Class L.—Lumber and timber:	
Jeremiah O'Neal	412.00
McKenzie, Oerting & Co	388.00
Frederick Bauer †	380.00
Henry Horster & Co	451.50
Class M.—Metals:	
Jeremiah O'Neal	72.10
McKenzie, Oerting & Co †	58.00
Frederick Bauer	62.00
Avery & Woolfolk	68.00
Henry Horster & Co	76.00
R. A. Robbins	67.20
Class N.—Naval stores:	
Jeremiah O'Neal	48.00
McKenzie, Oerting & Co †	47.40
Frederick Bauer	49.20
Avery & Woolfolk	48.00
Henry Horster & Co	60.00
R. A. Robbins	60.00
Class O.—Oils, etc.:	
Brooks Oil Company	365.70
Jeremiah O'Neal	446.50
McKenzie, Oerting & Co	381.87½
Frederick Bauer	410.90
Avery & Woolfolk	383.50
Henry Horster & Co	435.00
Manhattan Oil Company †	349.60
R. A. Robbins	460.50
Class T.—Tools and hardware:	
Jeremiah O'Neal	110.01
McKenzie, Oerting & Co	64.44½
Frederick Bauer †	54.43
Avery & Woolfolk	60.48
Henry Horster & Co	93.79
R. A. Robbins	294.02
Class W.—Wood and willow ware:	
Jeremiah O'Neal	9.00
McKenzie, Oerting & Co	11.25
Frederick Bauer	9.00
Avery & Woolfolk * †	9.00
Henry Horster & Co	9.75
R. A. Robbins	11.10

* Decided by lot. † Contract awarded.

Miscellaneous:	
Jeremiah O'Neal	$827.55
McKenzie, Oerting & Co*	693.95
Frederick Bauer	741.24
Henry Horster & Co	750.26

Schedule of proposals for supplies for United States Torpedo Station, Newport, received by Bureau of Provisions and Clothing under advertisement dated July 1, 1887.

Class F, 1.—Fuel:	
David S. Wells	$4,692.20
Gardiner B. Reynolds & Co*	4,387.50
David Duncan & Son	4,640.30
Class F, 2.—Fuel:	
Gardiner B. Reynolds & Co*	60.00
David Duncan & Son	65.00
Class O.—Oils and illuminants:	
Brooks Oil Company	165.00
Reed, Hall & Hewlett*	147.00
Manhattan Oil Company	156.00
Stevenson Bros. & Co†	212.00
Class T.—Tools and hardware:	
James W. Soper*	51.81
George L. Neville	90.50

Schedule of proposals for supplies for United States Naval Academy, received by Bureau of Provisions and Clothing, under advertisement dated July 1, 1887.

Class A, 1.—Fire apparatus, hose, etc:	
Gutta-percha and Rubber Manufacturing Company	$149.50
American Fire Hose Manufacturing Company*	142.00
Stevenson Bros. & Co †	195.00
R. A. Robbins	147.20
Class A, 2.—Apparatus and materials, photographic:	
Z. D. Gilman*	96.90
Class B, 1.—Brushes:	
R. A. Robbins*	3.90
Class B, 2.—Building material:	
R. A. Robbins*	53.50
Class C.—Chemicals and drugs:	
Z. D. Gilman*	224.09
Class F, 1.—Fuel:	
Joseph S. M. Basil*	1,460.25
David S. Wells	1,709.00
Class F., 2—Fuel:	
Joseph S. M. Basil ‡	205.00
West Virginia Central and Pittsburgh Railroad Company	11,810.00
Gilmor Meredith & Co*	11,147.00
David Duncan & Son	11,816.00
Class I.—Instruments and apparatus, mathematical and philosophical:	
Riehlé Brothers†	18.00
R. A. Robbins*	34.95
Class L.—Leather, rubber, and belting:	
Stevenson Bros. & Co †	4.55
R. A. Robbins*	4.20
Class M.—Metals:	
R. A. Robbins*	213.15
Class O.—Oils, etc.:	
Brooks Oil Company	161.80
Reuter & Mallory †	204.50
Manhattan Oil Company*	153.85
Stevenson Bros. & Co †	183.50
R. A. Robbins	187.25
Class S, 1.—Small stores:	
Z. D. Gilman	1.75
Stevenson Bros. & Co†	1.75
R. A. Robbins*	1.60

* Contract awarded. † Proposal informal. ‡ For part of class.

Class S, 2.—Engineers' supplies:	
R. A. Robbins*	$9.00
Class W.—Wood and willow ware:	
R. A. Robbins*	11.75
Miscellaneous:	
R. A. Robbins*	3.76

Schedule of proposals for supplies for navy-yard, Mare Island, received by Bureau of Provisions and Clothing, under advertisement dated July 1, 1887.

Class A.—Fire apparatus, hose:	
Albert Gallatin*	$1,978.31
Eureka Fire-hose Company	3,935.75
Dunham, Carrigan & Co	3,328.15
Gutta-percha and Rubber Manufacturing Company	2,075.40
Class B, 1.—Brushes:	
Lake & Co	1,264.31
Yates & Co*	871.34
Class B, 2—Building material:	
A. Powell	23,057.55
James McCudden*	20,341.60
Aden Bros	22,655.20
Class C, 1.—Canvas:	
Lake & Co*	409.84
Class C, 2.—Chemicals and drugs:	
Lake & Co	3,473.18
Yates & Co*	3,436.96
Class C, 3.—Cordage:	
Lake & Co†	2.00
James Gallup & Co†	.25
Class F, 1.—Fittings, boiler and engine:	
Albert Gallatin	3,146.45
Dunham, Carrigan & Co*	3,086.51
Class F, 2.—Furniture, galley and kitchen:	
Lake & Co*	487.14
Class F, 3.—Furniture, house:	
Lake & Co*	530.20
Class F, 4.—Fuel:	
James McCudden*	6,505.00
Aden Bros	6,520.00
Class F, 5.—Fuel:	
James McCudden*	18,494.00
Aden Bros	18,584.00
Class F, 6.—Fuel:	
James McCudden*	136.00
Aden Bros	170.00
Class F, 7.—Fuel:	
James McCudden	1,194.00
Aden Bros*	1,168.00
Class I.—Instruments and apparatus, mathematical and philosophical:	
Albert Gallatin*	287.03
Dunham, Carrigan & Co	396.10
Class L, 1.—Lamps and lanterns:	
William Porter's Sons	782.29
Yates & Co*	378.80
Class L, 2.—Leather, rubber, and belting:	
Albert Gallatin	2,141.77
S. H. Frank & Co	2,743.69
James Gallup & Co	1,991.05
A. O. Cook & Son*	1,413.65
Class L, 3.—Lumber and timber:	
Central California Lumber Company †	20,775.50
A. Powell	24,511.00
James McCudden*	24,305.05
Class M, 1.—Machinery and machine tools:	
Dunham, Carrigan & Co*	973.05

* Contract awarded. † Proposal informal.

Class M, 2.—Metals:	
Albert Gallatin	$8,420.03
Thomas H Selby & Co	8,542.95
George W. Gibbs & Co*	8,096.15
Dunham, Carrigan & Co	8,534.64
Class N.—Naval stores:	
Lake & Co	455.48
Whittier, Fuller & Co	390.85
James Gallup & Co*	388.30
Yates & Co	459.87
Aden Bros	556.00
Class O.—Oils, etc.:	
Brooks Oil Company*	3,991.93
Lake & Co	4,116.87
Manhattan Oil Company	4,062.05
Arctic Oil Works†	3,751.67
Reed, Hall & Hewlett	4,112.62
Class P, 1.—Pipe, steam, gas, water, etc.:	
Albert Gallatin*	2,874.54
Abner Doble	3,407.10
Dunham, Carrigan & Co	3,025.49
Class P, 2.—Provisions:	
James Gallup & Co*	16.50
Class S, 1.—Ship chandlery:	
Lake & Co	1,336.25
James Gallup & Co*	715.86
R. A. Robbins	1,105.18
Class S, 2.—Small stores:	
Lake & Co	78.13
James Gallup & Co*	59.55
R. A. Robbins	76.10
Class S, 3.—Engineers' supplies:	
Albert Gallatin*	2,351.72
Dunham, Carrigan & Co	2,665.10
R. A. Robbins	2,807.30
Class S, 4.—Plumbers' supplies,:	
Dunham, Carrigan & Co*	49.40
Class T.—Tools and hardware:	
Albert Gallatin*	3,109.64
Dunham, Carrigan & Co	3,660.85
Class W.—Wooden and willow ware:	
Lake & Co	453.00
James Gallup & Co*	344.75
Miscellaneous, No. 1:	
Lake & Co*	229.80
Miscellaneous, No. 2:	
A. Powell	1,610.00
James McCudden*	1,595.00
Aden Bros	1,610.00

Schedule of proposals for fresh provisions and navy bread for navy-yard, Washington, and Naval Academy, Annapolis, received by Bureau of Provisions and Clothing, under advertisement dated July 6, 1887, to be delivered during the fiscal year 1887–'88.

Charles E. Lyman: †	
Fresh beef, per pound ‡	$0.05
Vegetables, per pound ‡	.02
Joseph G. Carroll: †	
Fresh beef, per pound ‡	.05
Vegetables, per pound ‡	.0125
Jackson Brewer:	
Fresh beef, per pound §	.08
Vegetables, per pound §	.04
Martin M. Smith: *	
Fresh bread, per pound §	.035
John Kealy: *	
Fresh beef, per pound §	.0825
Vegetables, per pound §	.027

* Contract awarded.
† Proposal informal.
‡ To be delivered at Washington.
§ To be delivered at Annapolis.

Schedule of proposals for coffee for navy-yard, New York, received by Bureau of Provisions and Clothing, under advertisement dated July 21, 1887.

Coffee, 100,000 pounds, per pound:	
Joseph J. O'Donohoe, jr	$0.2025
Ed. B. Hosier	.2009
Thurber, Whyland & Co. *	.1997

Schedule of proposals for coal for training-station, Newport, R. I., received by Bureau of Provisions and Clothing, under advertisement dated July 21, 1887.

Chestnut coal (100 tons), per ton:	
Gardiner B. Reynolds & Co. *	$4.80
David Duncan & Son	4.95
Broken W. A. coal (1,300 tons), per ton:	
Gardiner B. Reynolds & Co. *	4.65
David Duncan & Son	4.75

Schedule of proposals for sundry navy supplies for navy-yard, Mare Island, received by Bureau of Provisions and Clothing, under advertisement dated July 21, 1887.

2,000 pounds corn meal (per pound):	
M. L. Kelly	$0.038
T. H. Dowling & Co. *	.0369
M. E. Ehrman & Co	.037
2,000 pounds oat meal (per pound):	
M. L. Kelly	.0525
T. H. Dowling & Co	.0518
M. E. Ehrman & Co. *	.051
3,000 pounds rice (per pound):	
M. L. Kelly	.0495
M. E. Ehrman & Co. *	.045
4,000 pounds pickles (per pound):	
M. L. Kelly	.06
T. H. Dowling & Co	.052
M. E. Ehrman & Co. *	.045
25,000 pounds sugar (per pound):	
M. L. Kelly	.0645
M. E. Ehrman & Co. *	.062
25,000 pounds coffee (per pound):	
Leege & Mills	.2882
M. L. Kelly	.25
T. H. Dowling & Co	.255
M. E. Ehrman & Co. *	.235
2,000 pounds canned tomatoes:	
M. L. Kelly	.0475
T. H. Dowling & Co. *	.043
M. E. Ehrman & Co	.05
1,000 gallons beans (per gallon):	
M. L. Kelly	.24
M. E. Ehrman & Co.*	.24
500 gallons molasses (per gallon):	
M. L. Kelly*	.28
M. E. Ehrman & Co	.30
800 gallons vinegar (per gallon):	
M. L. Kelly	.20
T. H. Dowling & Co. *	.15
M. E. Ehrman & Co	.20
3,600 pounds butter (per pound):	
M. L. Kelly. *	.28
M. E. Ehrman & Co	.285
50,000 pounds S. W. soap (per pound):	
Otto Luhn & Co	.0494
M. E. Ehrman & Co	.04⅛
Alta Soap Company *	.04

* Contract awarded.

100 mess kettles (each):	
W. W. Montague & Co	$0.90
Horace E. Wilder*	.76
John Brownlie	.77
100 mess pans (each):	
W. W. Montague & Co.*	.44
Horace E. Wilder	.53
John Brownlie	.50
1,000 tin pots (each):	
W. W. Montague & Co	.11
Horace E. Wilder	.0975
John Brownlie*	.09
1,000 tin pans (each):	
Horace E. Wilder	.08
John Brownlie*	.045
2,000 boxes blacking (per box):	
T. H. Dowling & Co.*	.035
M. E. Ehrman & Co	.0375
20,000 pounds candles (per pound):	
M. E. Ehrman & Co	.1375
Manhattan Oil Company	.125

Schedule of proposals for navy supplies for navy-yard, New York, received by Bureau of Provisions and Clothing, under advertisement dated July 28, 1888.

Lumber, etc.:	
George L. Neville	$49,762.24
Joseph W. Duryee*	38,440.75
Lewis H. Ross†	36,949.88
Eppinger & Russell†	20,258.67
Iron spikes:	
George L. Neville	1,591.30
P. H. McNulty*	1,419.86
Richard W. Creed	1,490.70
Rowland A. Robbins	1,594.70
Donegan & Swift	1,544.80
Albert Flagler	1,504.70
Roofing slate, brick, cement, and lime:	
Sweeny Brothers	1,533.00
Albert Flagler*	1,214.40
Tin, and iron spikes:	
George L. Neville	259.00
Richard W. Creed*	178.00
Rowland A. Robbins	195.50
Donegan & Swift	195.80
Albert Flagler	180.40
Ballast stone:	
John S. Howell — New York stone* ... per cubic yard	.78
John S. Howell — Hudson River stone ... do	.86
Hoisting engine for pile-driving:	
George L. Neville	1,694.00
Richard W. Creed	1,280.00
Donegan & Swift*	1,270.00
Albert Flagler	1,274.00

Schedule of proposals for sundry navy supplies for navy-yard, New York, received by Bureau of Provisions and Clothing under advertisement of July 29, 1887.

5,000 blankets (each):	
P. H. McNulty*	$2.32
B. Y. Pippey & Co	2.64
The S. F. Pioneer Woolen Factory	5.475
1,000 pairs kip shoes:	
Wm. McKnight*	2.15
200 pounds jute roving:	
P. H. McNulty*	.12
James R. Michael	.16

* Contract awarded. † Informal.

2,000 sweat leathers:	
Richard W. Creed	$0.08
P. H. McNulty*	.0595
James R. Michael	.06
500 dozen spools silk:	
P. H. McNulty (dozen)	.709
James R. Michael*	.63
500 boxes spool twist:	
P. H. McNulty	.369
James R. Michael*	.36
2,000 dozen spools cotton:	
P. H. McNulty	.4675
James R. Michael*	.46
500 gross small black navy buttons:	
P. H. McNulty*	.54
James R. Michael	.90
500 gross small white navy buttons:	
P. H. McNulty*	.54
James R. Michael	.75
10 great gross 27-line white bone buttons:	
P. H. McNulty*	1.38
James R. Michael	1.65
5 great gross 22-line white bone buttons:	
P. H. McNulty*	1.25
James R. Michael	1.35
20 pounds linen thread:	
Richard W. Creed	1.00
P. H. McNulty*	1.00
James R. Michael	1.40
300 pounds white cable cord:	
Richard W. Creed	.25
P. H. McNulty*	.1845
James R. Michael	.22
30 pounds black mounting cord:	
P. H. McNulty*	.64
James R. Michael	.75
500 dozen silver flax tape:	
P. H. McNulty*	.1995
James R. Michael	.22
50 dozen basting cotton:	
P. H. McNulty	.29
James R. Michael*	.20
20,000 clothing tickets:	
Richard W. Creed	.70
P. H. McNulty*	.60
James R. Michael	1.50

Schedule of proposals for lumber for New York navy-yard, received by Bureau of Provisions and Clothing under advertisement of July 20, 1887.

Cypress boards, 20,000 feet:	
C. F. Hodsdon*	$1,080.00
Jos. W. Duryee	900.00
White-cedar boards, 18,000 feet:	
C. F. Hodsdon*	972.00
Jos. W. Duryee	1,170.00

Schedule of proposals for engine lathes, tools, etc., for Norfolk navy-yard, received by Bureau of Provisions and Clothing under advertisement of July 29, 1887.

Machinists' tools, etc.:	
E. V. White & Co	$889.50
Geo. L. Neville	918.00
Albert Flagler*	640.16
E. J. Griffith & Co	944.00
E. L. Mayer and W. H. Taylor	942.00

*Contract awarded.

Machinery:
- E. V. White & Co $4,020.00
- Geo. L. Neville 3,965.00
- Albert Flagler * 2,376.00
- E. J. Griffith & Co 4,075.00
- E. L. Mayer and W. H. Taylor 4,225.00

Schedule of proposals for navy supplies for navy-yard, Portsmouth, received by Bureau of Provisions and Clothing under advertisement of August 3, 1887.

Lumber, etc.:
- J. W. Gaskill & Sons* $8,451.00
- Geo. McQuestion & Co 11,999.50
- Geo. L. Neville 8,725.00

Oakum, pitch, mop-yarn, etc.:
- J. W. Gaskill & Sons 1,147.00
- Rider & Cotton* 783.10
- Geo. L. Neville 1,095.50

Schedule of proposals for sundry navy supplies for navy-yard, New York, received by Bureau of Provisions and Clothing under advertisement dated August 6, 1887.

10,000 yards cloth for trousers (per yard):
- San Francisco Pioneer Woolen Factory * $2.1875
- R. A. Robbins 2.33

5,000 red silk handkerchiefs:
- P. H. McNulty 1.23
- James R. Michael * 1.19

9,000 pairs calf shoes:
- J. Freeman & Co * 2.13

10,000 pairs woolen socks:
- B. Y. Pippey & Co * .... .3425
- P. H. McNulty .... .3985

2,500 mattresses:
- B. Y. Pippey & Co 5.10
- P. H. McNulty 5.95
- Williard Wenrich Moyer * 4.58

35,000 yards of unbleached cotton duck:
- G. K. Sheridan & Co * .... .1173
- James R. Michael .... .1231
- R. A. Robbins .... .1230

10,000 watch caps:
- B. Y. Pippey & Co .... .5825
- P. H. McNulty * .... .58

28,000 spools silk:
- P. H. McNulty * .... .0332
- James R. Michael .... .045
- Albert Flagler .... .0366

10,000 spools thread:
- Barbour Bros. & Co .... .055
- P. H. McNulty * .... .054
- James R. Michael .... .0549
- Albert Flagler .... .061

5,000 pieces tape:
- P. H. McNulty .... .0175
- James R. Michael (dozen) * .... .19

3,000 spools cotton:
- P. H. McNulty .... .0383
- James R. Michael (dozen)* .... .45
- Albert Flagler .... .046

1,000 papers needles:
- P. H. McNulty * .... .045
- James R. Michael .... .08

1,000 razors:
- Albert Flagler * .... .2495

1,000 razor strops:
- Albert Flagler * .... .249

*Contract awarded.

1,000 shaving brushes:	
Richard W. Creed *	$0.089
James S. Barron & Co	.0987
Albert Flagler	.092
5,000 shoe brushes:	
Richard W. Creed	.179
James S. Barron & Co *	.1747
Albert Flagler	.189
3,000 scrub brushes:	
Richard W. Creed *	.119
James S. Barron & Co	.149
Albert Flagler	.122
5,000 wisp brooms:	
Richard W. Creed	.18
James S. Barron & Co *	.1717
Albert Flagler	.1799
5,000 spoons:	
The F. T. Witte Hardware Company *	.022
James M. Shaw & Co	.0229
Richard W. Creed	.025
James S. Barron & Co	.0297
Albert Flagler	.024
5,000 forks:	
The F. T. Witte Hardware Company *	.02¼
James M. Shaw & Co	.0274
Richard W. Creed	.039
Albert Flagler	.042
10,000 boxes blacking:	
The Chesebro Manufacturing Company *	.025
P. H. McNulty	.029
George T. Noe	.0249
James S. Barron & Co	.0273
Albert Flagler	.032
50,000 pounds candles:	
Thurber, Whyland & Co	.1035
Manhattan Oil Company *	.1025
Reed, Hall & Hewlett	.10 7/16
R. G. Mitchell & Co	.104
500 padlocks:	
The F. T. Witte Hardware Company	.89
Richard W. Creed *	.68
James W. Soper	.9175
Albert Flagler	.894

*Schedule of proposals for capstan engine for navy-yard, **Portsmouth, N. H., received by** Bureau of Provisions and Clothing, under **advertisement of August 10, 1887.***

American Ship Windlass Company †	$1,700.00
Manton Steam Steerer and Windlass Works †	1,795.00

*Schedule of proposals for dredging at Newport, R. I., **received by Bureau of Provisions** and Clothing, under advertisement of **September 17, 1887.***

C. W. Anthony, per cubic yard †	$0.40

*Schedule of proposals for navy supplies, New York yard, **received by Bureau of Provisions** and Clothing, under advertisement of **September 17, 1887.***

50,000 pounds canned roast beef (per pound):	
Fred. W. Bogert	$0.07 11/16
Thurber, Whyland & Co *	.0702
Armour & Co	.0725
30,000 pounds canned ham (per pound):	
Armour & Co	.14
Kemp, Day & Co *	.13

* Contract awarded. † Informal.

10,000 gallons beans (per gallon):	
Mich'l Doylet	$0.3050
Kemp, Day & Co	.2950
Edw. B. Hosier*	.284
Wm. H. Belford	.3550
10,000 pounds dried peaches (per pound):	
Mich'l Doylet	.3450
Thurber, Whyland & Co*	.28
Kemp, Day & Co	.38
25,000 pounds pickles (per pound):	
Kemp, Day & Co*	.073
F. Forenbach & Co.†	.07
Edw. B. Hosier	.0745
50,000 pounds canned tomatoes (per pound):	
Thurber, Whyland & Co	.0482
Kemp, Day & Co	.0393
Edw. B. Hosier	.0385
Wm. H. Belford*	.0375
75,000 pounds assorted vegetables (per pound):	
Thurber, Whyland & Co	.0691
Kemp, Day & Co	.0647
Edw. B. Hosier*	.0622

Schedule of proposals for continuous-service certificates, received by Bureau of Provisions and Clothing, under advertisement of October 4, 1887.

Callahan & Gartlan	$2,740.00
American Bank-note Company*	1,680.00
E. E. Rider	2,250.00
N. G. Fisher	1,860.00

Schedule of proposals for stationery and building repairs at Newport, R. I., received by Bureau of Provisions and Clothing, under advertisement of October 8, 1887.

Stationery:	
J. W. Bond & Co*	$127.45
M. E. Leathe	164.20
Building repairs:	
Oscar E. Peabody	1,403.00
Michael F. Murphy	1,425.00
William F. Wilbur*	1,100.00
H. W. Wilson, jr	1,500.00

Schedule of proposals for prime mess pork for Mare Island, California, received by Bureau of Provisions and Clothing, under advertisement of October 10, 1887.

Merry, Faull & Co.:*	
125 barrels	$17.00
250 half-barrels	9.25

Schedule of proposals for 100,000 yards of flannel, received by Bureau of Provisions and Clothing, under advertisement of October 18, 1887, for navy-yard, New York.

San Francisco Pioneer Woolen Factory*	$0.8981
Henry T. Kent, executor estate of Thomas Kent	.9650
B. Y. Pipply & Co	.9925
Peter H. McNulty	1.0850

Schedule of proposals for brick and granite, received by Bureau of Provisions and Clothing, under advertisement of October 22, 1887, for navy-yard, Washington, D. C.

565,000 brick:		
Albert Flagler*	per 1,000	$7.40
National Press Brick Company	do	9.00

* Contract awarded. † Informal.

Granite:

James Symington	$2,945.00
Davidson & Sons	2,413.00
Berry & McFrederick*	2,300.00
Acker & Co	2,572.53
Richard Rothwell & Son	2,611.12

Schedule of proposals for cement, sand, stone, and lime, received by Bureau of Provisions and Clothing, under Bureau's advertisement of October 22, 1887, navy-yard, Washington.

2,000 barrels hydraulic cement:		
Albert Flagler		$1.24½
James G. and John M. Waters*		1.12
A. F. Carman		1.37
6,825 barrels sand:		
Robert M. Miller*	per barrel	.12
J. W. Gaskill & Sons	do	.53
Andrew Neville	do	.13
10,000 barrels stone:		
James J. Donovan	per barrel	.49
George B. Clarke	do	.37
J. W. Gaskill & Sons	do	.43
A. F. Carman	do	.52½
Andrew Neville*	do	.25
565 barrels lime:		
Albert Flagler		.90
George B. Clarke	in bulk	.60
Pickering Dodge*	do	.59
Camuck & Decker	per barrel	.90
John J. Kelly & Co	do	1.00

Schedule of proposals for yellow pine, received by Bureau of Provisions and Clothing, under advertisement of October 22, 1887, for navy-yard, Washington, D. C.

J. W. Gaskill & Sons	$6,407.85
Norwood and Butterfield Company	8,608.75
George L. Neville*	5,571.87
William D. Gill	5,629.44

Schedule of proposals for duck and other naval supplies, received by Bureau of Provisions and Clothing, under advertisement dated November 2, 1887, for navy-yard, New York.

5,000 yards tan-colored duck:		
J. R. Michael		$0.2247
R. A. Robbins*		.2224
T. A. Ashburner		.2309
25,000 yards bleached duck:		
J. R. Michael*		.1867
R. A. Robbins		.1947
2,000 shaving boxes:		
A. Flagler	each	.74
P. H. McNulty*	do	.57
J. R. Michael	do	1.03
S. Y. L'Hommedieu & Co	do	.58
The India Rubber Comb Company	do	.6250
R. A. Robbins	do	1.0497
5,000 cakes shaving soap:		
A. Flagler*	per cake	.0395
P. H. McNulty	do	.07
J. R. Michael		.0840
R. A. Robbins		.09
30,000 pounds apples:		
Thurber, Whyland & Co		.1191
Kemp, Day & Co		.125
E. B. Hosier*		.1095

* Contract awarded.

3,000 gallons split peas:	
Thurber, Whyland & Co*	$0.198
Kemp, Day & Co	.23
E. B. Hosier	.1994
3,000 pounds tea:	
Thurber, Whyland & Co	.2694
M. F. Powers	.30
E. B. Hosier	.2950
John G. Mars*	.24
1,000 bread bags:	
W. A. Wheeler ... each	.79
J. R. Michael* ... do	.54
5 iron safes, first size:	
Marvin Safe Company ... each	49.00
J. R. Michael* ... do	47.00
10 iron safes, second size:	
William H. Butler ... each	114.00
Marvin Safe Company ... do	42.00
A. Flagler ... do	98.75
J. R. Michael* ... do	39.00
10 iron safes, third size:	
Marvin Safe Company ... each	38.50
J. R. Michael* ... do	34.00
10 sets yeoman stores, 300 men:	
A. Flagler	55.07
J. R. Michael	56.00
R. A. Robbins*	55.20
10 sets, 200 men:	
A. Flagler	52.99
J. R. Michael	54.00
R. A. Robbins*	52.73
5 sets, 100 men:	
A. Flagler	45.75
J. R. Michael	45.00
R. A. Robbins*	43.97

Schedule of proposals for rice, canvas, and machinery received by Bureau of Provisions and Clothing, under advertisement dated November 5, 1887, for navy-yards, Boston, New York, and Washington.

25,000 pounds rice:	
E. B. Hosier*	$5.83
Thurber, Whyland & Co	5.86
1,000 dozen eagle buttons (per dozen):	
Thomas Y. Hood	.3125
P. H. McNulty	.32
J. R. Michael*	.26
10,000 yards hammock-canvas:	
R. A. Robbins*	.5370
J. R. Michael	.5410
5,000 yards bag-canvass:	
R. A. Robbins*	.4486
J. R. Michael	.4497
132 boxes American glass:	
R. A. Robbins	741.84
J. W. Gaskill & Sons	771.60
Albert Flagler	682.60
F. B. Annadown*	650.94
5,000 pounds roofing-felt (per pound):	
R. A. Robbins	.03
J. W. Gaskill & Sons	.0225
Charles J. Fanning	.03
Albert Flagler*	.0125
10 boxes charcoal tin:	
R. A. Robbins*	8.95
J. W. Gaskill & Sons	13.75

*Contract awarded.

253 squares P. B. slate:	
R. A. Robbins	$8.20
J. W. Gaskill & Sons	8.20
Charles J. Fanning*	6.35
Albert Flagler	8.19
500 pounds galvanized-iron slating-nails:	
R. A. Robbins*	.05
J. W. Gaskill & Sons	.09
Charles J. Fanning	.0650
Albert Flagler	.0650
600 pounds putty:	
R. A. Robbins*	.02
J. W. Gaskill & Sons	.0250
100 pounds solder:	
R. A. Robbins*	.18
J. W. Gaskill & Sons	.27
40 boxes I. C. roofing-tin:	
R. A. Robbins*	4.90
J. W. Gaskill & Sons	7.95
4,092 square feet glazing:	
R. A. Robbins*	.50
22,950 pounds iron-work:	
P. H. McNulty	2,175.06
J. R. Michael*	918.00
5 16-inch shaping machines:	
Bement, Miles & Co	1,648.75
Niles Tool Works*	1,450.00
William H. Warren†	1,330.00
S. C. Forsmith Machine Company	969.25
R. A. Robbins	1,640.00
J. W. Gaskill & Sons	2,140.00
Fraser & Archer	1,594.00
1,200 pieces and 26,000 feet yellow and white pine lumber:	
J. W. Gaskill & Sons*	4,498.14
5 21-inch shaping machines, with tool-holder and clamping-vise:	
Bement, Miles & Co	2,498.25
Niles Tool Works*	2,025.00
R. A. Robbins	2,440.00

Schedule of proposals for evaporated apples, beef, tea, etc., received by Bureau of Provisions and Clothing, under advertisement dated November 19, 1887, for Mare Island, Cal., navy-yard.

2,000 pounds evaporated apples:	
Goldberg, Bowen & Co	$0.1450
Haas Bros.*	.1325
M. Ehrman & Co	.21
Lebenbaum Bros	.1450
5,000 pounds canned roast beef:	
T. H. Dowling & Co	.0784
Goldberg, Bowen & Co	.0825
Armour & Co	.0825
Haas Bros	.0875
M. Ehrman & Co	.09
Lebenbaum Bros	.09
John C. Jahring*	.07¾
5,000 pounds canned corned beef:	
T. H. Dowling & Co	.0925
Goldberg, Bowen & Co	.0925
Armour & Co	.0850
Haas Bros	.10
M. Ehrman & Co	.11
Lebenbaum Bros	.10
John C. Jahring*	.08¼
1,000 pounds tea:	
T. H. Dowling & Co	.47
Goldberg, Bowen & Co	.2750
Haas Bros	.40
M. Ehrman & Co	.40
Lebenbaum Bros	.5075

* Contract awarded. † Informal.

3,000 barrels canned vegetables:	
T. H. Dowling & Co	$0.084
Goldberg, Bowen & Co.*	.0750
Haas Bros	.0750
M. Ehrman & Co	.08
Lebenbaum Bros	.0850

Schedule of proposals for 1,000 tons anthracite broken coal for navy-yard, Boston, Mass., received by Bureau of Provisions and Clothing, under advertisement dated November 26, 1887.

David Duncan & Son (per ton)*	$5.85

Schedule of proposals for provender received by Bureau Provisions and Clothing, under advertisement December 10, 1887, for Naval Training Station, Coaster's Harbor Island, R. I.

James G. Stevens, Newport, R. I.:		
4 tons timothy hay*	per ton	$21.00
2 tons rye straw*	do	22.00
200 bushels oats, 32 pounds to bushel*	per bushel	.52

Schedule of proposals for pork and vinegar received by Bureau Provisions and Clothing, under advertisement December 17, 1887, for navy-yard, Brooklyn, N. Y.

157 barrels vinegar:		
Edward B. Hosier	per gallon	$0.136
Thurber, Whyland & Co	do	.1333
Edward Reinecke*	do	.1324
Foehrenbach & Co	per gallon	.13$\frac{9}{32}$
	per barrel	4.36
Edesheimer Brothers	per gallon	.13$\frac{9}{32}$
	per barrel	4.25
500 barrels pork:		
James A. Craig*	per barrel	16.47
William H. Belford	do	17.00

Schedule of proposals for mess pork received by Bureau Provisions and Clothing, under advertisement January 7, 1888, for navy-yard, Mare Island, California.

Merry, Faull & Co.:*		
125 barrels family mess pork	per barrel	$19.95
250 half-barrels same	per half barrel	10.95

Proposals for broken stone, etc., for Washington Navy-Yard, received by Bureau Provisions and Clothing, under advertisement December 31, 1887.

6,000 barrels broken stone:		
John A. Bouker		$0.40
W. H. B. Stout		840.00
John McClenehan & Bro		.43
George B. Clarke*		.39$\frac{1}{4}$
McCarthy & Baldwin	per cubic yard	1.95
J. W. Gaskill & Sons		.47
2,000 barrels cement:		
J. G. & I. N. Waters		1.12
H. W. Blunt*		.90
George B Clarke		1.10
J. W. Gaskill & Sons		1.65

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* Contract awarded.

18,000 bushels sand:	
George B. Clarke	$0.04½
John B. Lord	.04
H. E. Young	.11
E. E. Burrough	.06
Robert M. Miller* { first	.04½
{ second	.03¾
J. W. Gaskill & Sons	.15
46,000 fire-brick:	
George B. Clarke	31.60
S. M. Hamilton & Co	30.00
George L. Neville	44.74
J. Edward Bates*	26.46
E. J. Griffith & Co	30.23
J. Blake Kendall	35.75
McCarthy & Baldwin	28.50
J. W. Gaskill & Sons	47.00
23 pieces granite coping and 36 granite steps:	
Brandywine Granite Company *	1,123.40
Gill & McMahan	1,175.00
John Lane & Malnate	1,542.00
Taylor & Son	1,545.00
W. H. B. Stout	1,235.00
Berry & McFrederick	1,490.00
W. F. Weller	1,416.64
M. Gault & Son	1,573.00
Richard Rothwell & Son	1,600.00
Cuthbert Walker	1,688.75
Davidson & Son	1,522.60
J. W. Gaskill & Sons	2,007.00
23 pieces granite coping:	
McAuliff & Kelly	1,125.00
John Burns	852.00
John McCleneban & Bro	564.93
Westham Granite Company, Virginia	625.95
36 granite steps:	
McAuliff & Kelly	499.20
John Burns	780.00
John McClenehan & Bro	594.00
Westham Granite Company, Virginia	674.50
2,500 pounds block tin: †	
George L. Neville	.50
E. J. Griffith & Co	.442

Schedule of proposals for building materials for United States Training Station, received by Bureau Provisions and Clothing, under advertisement dated January 7, 1888.

Spruce, hemlock, white and yellow pine:	
Albert Hamett ‡	$50.75
Swinburne, Peckham & Co.*	52.69
Shingles:	
Albert Hamett‡	5.00
Swinburne, Peckham & Co.*	4.00
Hardware:	
Albert Hamett ‡	42.45
Swinburne, Peckham & Co.*	43.89
Paints and putty:	
Albert Hamett‡	38.25
Mason, Chapin & Co.*	30.78
Swinburne, Peckham & Co	38.49
Glass:	
Albert Hamett ‡	8.00
Mason, Chapin & Co.*	5.25
Swinburne, Peckham & Co	7.66
Stove-pipe and water-pipe:	
Albert Hamett‡	28.80
Swinburne, Peckham & Co.*	31.20

* Contract awarded † No award for tin; bids too high. ‡ Proposal informal.

ors:

Albert Hamett*	$30.00
Swinburne, Peckham & Co.†	39.00

edule of proposals for provisions and clothing, navy yard, New York, received by Bureau Provisions and Clothing, under advertisement dated January 21, 1888.

nnel, 6-4, 10-ounce, light, 10,000 yards:	
P. H. McNulty	$0.925
San Francisco Pioneer Woolen Factory †	.695
B. Y. Pippey & Co	.745
p cloth, 5,000 yards:	
Henry Lewis	1.99
P. H. McNulty	2.37
San Francisco Pioneer Woolen Factory†	1.795
B. Y. Pippey & Co	2.17
tton duck, unbleached, 50,000 yards:	
P. H. McNulty	.1221
Rowland A. Robbins †	.1209
James R. Michael	.1221
lf shoes, 3,000 pairs:	
Charles Hewitt	2.24
George F. Roedel	2.175
James R. Michael	2.24
J. Freeman & Co. †	1.95
p shoes, 2,000 pairs:	
Charles Hewitt	2.11
George F. Roedel	2.225
W. McKnight †	2.10
James R. Michael	2.34
J. Freeman & Co	2.21
oolen socks, 10,000 pairs:	
P. H. McNulty	.3347
B. Y. Pippey & Co.†	.305
ttresses, 1,500:	
P. H. McNulty	4.56
William F. Bernstein †	4.4475
W. Weinrich Moyer	4.58
gar, 100,000 pounds:	
James R. Michael †	.0683
Thurber, Whyland & Co	.06865

edule of proposals for tubing, nuts, oils, etc., for navy-yard, Washington, received by Bureau of Provisions and Clothing under advertisement dated February 4, 1888.

pper tubing, drawn, 539 feet:	
American Tube Works †	$0.45
ire rope, 265 feet:	
E. J. Griffith & Co	.125
Robert Boyd †	.119
J. B. Kendall	.125
James J. Donovan	.15
Richard W. Creed	.14
erm oil, winter strained, 6 barrels:	
E. J. Griffith & Co	.70
Robert Boyd	.749
J. B. Kendall	.75
J. Edward Bates †	.65½
Charles Becker	.80
James J. Donovan	.72
Richard W. Creed	.68
Manhattan Oil Company	.675
James R. Michael	.76
Stevenson Bros. & Co	.75
W. H. Butler	.70
Reed. Hall & Hewlett	.69

* Proposal informal. † Contract awarded.

Charcoal, 2,000 bushels:		
Robert Boyd		$0.09
J. B. Kendall *		.079
James J. Donovan		.20
Richard W. Creed		.20
James R. Michael		.085
Nuts, hexagon, 1,500 pounds:		
E. J. Griffith & Co		.0575
Robert Boyd		.057
J. B. Kendall		.11½
J. Edward Bates *		.0541
James T. Donovan		.07
Richard W. Creed		.0620
James R. Michael		.065
Screw-wrenches, 4 dozen:		
E. J. Griffith & Co		4.30
Robert Boyd		4.49
J. B. Kendall *		3.70
James J. Donovan		7.00
Richard W. Creed		4.75
James R. Michael		7.15
Iron washers, 200 pounds:		
E. J. Griffith & Co		.042
Robert Boyd		.039
J. B. Kendall		.0425
J. Edward Bates *		.0349
James J. Donovan		.06
Richard W. Creed		.04
James R. Michael		.05
Gum packing, 200 pounds:		
E. J. Griffith & Co		.19
Robert Boyd		.19
J. B. Kendall *		.12
James J. Donovan		.55
Richard W. Creed		.25
James R. Michael		.48
Stevenson Bros. & Co		.275
Neats-foot oil, 20 gallons:		
E. J. Griffith & Co		.74
Robert Boyd		.70
J. B. Kendall		.70
J. Edward Bates		.655
Charles Becker		.80
James J. Donovan		.80
Richard W. Creed		.65
Manhattan Oil Company *		.60
James R. Michael		.80
Stevenson Bros. & Co		.85
W. H. Butler		.70
Reed, Hall & Hewlett		.65
Stencil paper, 1 roll:		
James R. Michael *	per pound	.09
White chalk, 500 pounds:		
Robert Boyd		.0125
J. B. Kendall		.02
J. Edward Bates *		.0089
Charles Becker		.0095
James J. Donovan		.02
Richard W. Creed		.03
James R. Michael		.45
Oil-stones, 2 dozen:		
E. J. Griffith & Co		4.40
Robert Boyd	per pound	.27
J. B. Kendall		5.00
James J. Donovan		48.00
Richard W. Creed *		3.50
James R. Michael		5.00

* Contract awarded.

Gum camphor, 20 pounds:	
E. J. Griffith & Co	$0.40
Robert Boyd	.40
J. B. Kendall	.30
Charles Becker	.30
Richard W. Creed	.30
James R. Michael * †	.30
Yellow pine, Georgia, 2,308 feet:	
W. W. McCullough ‡	126.94

Schedule of proposals for provisions, navy-yard, Mare Island, received by Bureau Provisions and Clothing, under advertisement dated February 18, 1888.

6,000 pounds cornmeal:	
M. Ehrmann & Co	.04
Haas Brothers*	$.03\frac{95}{100}$
T. H. Dowling & Co	$.04\frac{1}{2}$
6,000 pounds oatmeal:	
M. Ehrmann & Co	$05\frac{1}{10}$
Haas Brothers*	$.04\frac{95}{100}$
T. H. Dowling & Co	$.05\frac{2}{10}$
5,000 pounds hominy:	
M. Ehrmann & Co	$.04\frac{6}{10}$
Haas Brothers*	$.04\frac{1}{2}$
T. H. Dowling & Co	$.04\frac{79}{100}$
150 half-barrels flour:	
M. Ehrmann & Co	$.02\frac{5}{8}$
Haas Brothers*	$.02\frac{1}{2}$
T. H. Dowling & Co	$.02\frac{1}{2}$
1,500 gallons white beans:	
M. Ehrmann & Co	.04
Haas Brothers*	$.30\frac{1}{2}$
800 gallons split peas:	
M. Ehrmann & Co	.30
Haas Brothers*	$.27\frac{1}{2}$
T. H. Dowling & Co	.28
6,000 pounds rice:	
M. Ehrmann & Co.*	$.05\frac{3}{10}$
Haas Brothers	$.05\frac{475}{1000}$
5,000 pounds butter:	
M. Ehrmann & Co	.35
Haas Brothers*	$.27\frac{1}{2}$
Simpson, McIntyre & Co	.34
6,000 pounds canned tomatoes:	
M. Ehrmann & Co	$.04\frac{1}{4}$
Haas Brothers*	.04
T. H. Dowling & Co	$.4\frac{1}{4}$
6,000 pounds canned sausage:	
M. Ehrmann & Co	.19
Haas Brothers	$.13\frac{1}{2}$
T. H. Dowling & Co.*	.13
Merry, Faull & Co	$.14\frac{1}{2}$
6,000 pounds canned salmon:	
M. Ehrmann & Co	.15
Haas Brothers*	$.13\frac{7}{8}$
H. Levi	$.14\frac{3}{8}$
2,000 pounds boneless codfish:	
M. Ehrmann & Co	$.09\frac{1}{4}$
Haas Brothers	.10
T. H. Dowling & Co.*	$.08\frac{3}{4}$
2,000 pounds ham:	
M. Ehrmann & Co	.15
Haas Brothers	$.13\frac{3}{4}$
T. H. Dowling & Co	$.13\frac{5}{8}$
Merry, Faull & Co.*	$.13\frac{375}{1000}$
2,000 pounds bacon:	
M. Ehrmann & Co	.14
Haas Brothers	$.12\frac{1}{2}$
T. H. Dowling & Co	$.12\frac{5}{8}$
Merry, Faull & Co.*	$.11\frac{375}{1000}$

* Contract awarded. † Decided by lot. ‡ Informal.

2,000 pounds cocoa:	
M. Ehrmann & Co	$0.31
Haas Brothers*	.25
T. H. Dowling & Co	.26
6,000 pounds pickles:	
M. Ehrmann & Co	.05¼
Haas Brothers	.05¾
T. H. Dowling & Co.*	.05
1,000 gallons molasses:	
M. Ehrmann & Co	.35
Haas Brothers*	.35
1,000 gallons vinegar:	
M. Ehrmann & Co	.18¼
Haas Brothers	.15
T. H. Dowling & Co.*	.13½
9,000 pounds canned vegetables:	
M. Ehrmann & Co	.09
Haas Brothers*	.06¼
H. Levi	.07¼
T. H. Dowling & Co	.07¾

Schedule of proposals for coal for U. S. Naval Academy, received by Bureau Provision and Clothing, under advertisement dated February 18, 1888.

300 tons Newburgh Orrel, Youghiogheny:	
Meredith, Winship & Co.*	$3.85
Black, Sheridan & Wilson †	3.73
100 tons George's Creek, Big Vein:	
Meredith, Winship & Co.*	3.15
Black, Sheridan & Wilson †	3.15

Schedule of proposals for boilers for navy-yard, Washington, received by Bureau Provisions and Clothing, under advertisement dated March 3, 1888.

Five boilers, Babcock & Wilcox patent:	
Babcock & Wilcox Company*	$23,886
James P. Witherow { K, 5 boilers	16,800
James P. Witherow { L, 4 boilers	16,550
Edward J. Moore †	20,000
George M. Newhall & Bro. †	16,900
Abendroth Root Manufacturing Company †	19,270

Schedule of proposals for building, piling, etc., for U. S. Naval Training Station, received by Bureau of Provisions and Clothing, under advertisement dated March 13, 1888.

Building improvements:	
John Crimmins (plumbing only)	$998.00
Charles H. Taber	4,600.00
Lynch & Sullivan (heating and building only)	2,020.00
Benjamin F. Tanner	3,277.00
Michael A. McCormick*	2,960.00
James Dowling	4,273.00
William F. Wilbur	3,973.00
Piling, etc.:	
James A. Eddy*	1,540.00
Stillman Saunders	1,678.40

Schedule of proposals for coal for navy-yard, New York, received by Bureau Provisions and Clothing, under advertisement dated March 10, 1888.

1,000 tons anthracite, broken:	
David Duncan & Son	$4.14
David S. Wells*	4.04

* Contract awarded. † Proposal informal.

edule of proposals for engine, etc., and repairs to building for navy-yard, Washington, eceived by Bureau Provisions and Clothing, under advertisement dated March 17, 1888.

Three engines, 77 horse-power:		
mington & Sims*	H..	$753.35
mington & Sims		2,584.00
W. Payne & Sons	G..	450.00
One engine, 30 horse-power:		
mington & Sims*	G..	806.50
W. Payne & Sons	H..	300.00
One engine, 20 horse-power:		
mington & Sims*		878.50
Air-pumps, Davidson:		
vidson Steam-Pump Company (No. 1)*		375.00
vidson Steam-Pump Company (No. 2)*		1,000.00
e Deane Steam-Pump Company (Nos. 1 and 2)		1,585.00
Repairs to eight-inch gun shop:		
wland A. Robbins*		2,999.00

edule of proposals for tobacco received by Bureau of Provisions and Clothing under advertisement dated March 24, 1888.

),000 pounds tobacco, Navy:	
William Buchanan	$0.34
Myers Bros. & Co	.37
P. Lorillard & Co.†	.2493
Do	.2762
P. J. Sorg & Co.†	.28
Do	.30
P. H. Mayo & Bro.*	.38
J. B. Pace Tobacco Company †	.37
Do	.30
Boykin, Seddom & Co.†	.29
Do	.28
Thomas E. Hicks & Co	.27

edule of proposals for clothing and small stores for the Navy received by Bureau of Provisions and Clothing under advertisement dated April 14, 1888.

00 black silk neckerchiefs:	
A. Flagler	$1.99
Rowland A. Robbins	1.22
Thomas G. Hood	1.149
James R. Michael	1.11
P. H. McNulty*	.99
00 alpaca neckerchiefs:	
James R. Michael*	.19
P. H. McNulty	.22
00 pairs rubber boots:	
A. Flagler	2.15
C. J. Townsend*	1.95
James Huggins	2.39
James R. Michael	2.39
P. H. McNulty	2.24
00 oilskin suits and hats:	
A. Flagler*	1.71
Rowland A. Robbins	1.73
James R. Michael	4.00
P. H. McNulty	2.10
Standard Oil Clothing Company	1.715
5,000 pounds salt-water soap:	
A. Flagler	
Rowland A. Robbins	
James R. Michael	
P. H. McNulty*	
Charles McKeone	

* Contract awarded. †

7,200 spools cotton:	
A. Flagler	$0.0375
E. E. Earnes	.032
Callahan & Gartlan	.045
Rowland A. Robbins	.034
James R. Michael	.03
P. H. McNulty*	.026
5,000 pocket handkerchiefs:	
A. Flagler	.07
Rowland A. Robbins	.082
Thomas G. Hood	.08¾
James R. Michael	.07
P. H. McNulty*	.0675
James E. Young	.07
2,500 needles, papers:	
A. Flagler	.04
C. J. Townsend	.04
Callahan & Gartlan	.025
James R. Michael	.04
P. H. McNulty*	.025
5,000 pieces red worsted tape:	
A. Flagler	.04¾
Callahan & Gartlan	.0125
Rowland A. Robbins	.047
James R. Michael	.0497
P. H. McNulty*	.0325
5,000 pieces blue worsted tape:	
A. Flagler	.04¾
Callahan & Gartlan	.0125
Rowland A. Robbins	.047
James R. Michael	.0497
P. H. McNulty*	.0325
4,000 tin pans:	
A. Flagler	.0625
Francis T. Witte Hardware Company	.075
Henderson & Stoutenburgh	.06
Rowland A. Robbins*	.049
2,000 tin pots:	
A. Flagler	.079
Francis T. Witte Hardware Company	.0825
Henderson & Stoutenburgh	.07
Rowland A. Robbins*	.059
1,000 mess kettles:	
A. Flagler	.49
Francis T. Witte Hardware Company	.462
Henderson & Stoutenburgh	.525
Rowland A. Robbins*	.409
5,000 jackknives:	
A. Flagler*	.36
Callahan & Gartlan	.45
James R. Michael	.449
W. F. Rockwell	.45
1,200 dozen ivory buttons, medium:	
C. J. Townsend	.061
Callahan & Gartlan	.06½
Rowland A. Robbins	.064
Thomas G. Hood*	.0625
James R. Michael	.04½
P. H. McNulty	.065
1,200 dozen ivory buttons, small:	
C. J. Townsend	.042
Callahan & Gartlan	.0475
Rowland A. Robbins	.045
Thomas G. Hood	.045
James R. Michael*	.04½
P. H. McNulty	.05

* Contract awarded.

5,000 blacking boxes:	
A. Flagler*	$0.024
C. J. Townsend	.027
E. E. Earnes	.032
Callahan & Gartlan	.0325
Rowland A. Robbins	.0273
James R. Michael	.03
P. H. McNulty	.035
7,000 spoons:	
A. Flagler	.0219
Francis T. Witte Hardware Company	.0225
Henderson & Stoutenburgh	.025
Callahan & Gartlan	.0225
Rowland A. Robbins	.022
James R. Michael*	.02
1,000 dozen rubber buttons, large:	
C. J. Townsend	.33
Callahan & Gartlan	.36
Rowland A. Robbins	.374
Thomas G. Hood*	.295
James R. Michael	.80
P. H. McNulty	.39
4,200 towels:	
A. Flagler*	.145
Rowland A. Robbins	.1997
Thomas G. Hood	.17
James R. Michael	.19
P. H. McNulty	.22
James F. White & Co	.1875
500 tooth-brushes:	
A. Flagler*	.11
E. E. Earnes	.15¼
Callahan and Gartlan	.15
James R. Michael	.19
P. H. McNulty	.19
1,000 pounds toilet soap:	
A. Flagler	.165
Rowland A. Robbins	.159
P. H. McNulty*	.099
2,000 yards enameled cloth:	
A. Flagler	.2699
Callahan & Gartlan	.26
Rowland A. Robbins	.269
James R. Michael	.29
P. H. McNulty*	.25

Schedule of proposals for rails, ties, coal, wire, etc., for navy yards, Boston and Norfolk, received by Bureau of Provisions and Clothing, under advertisement dated April 14, 1888.

156 tons steel rails, 50 pounds to yard:	
O. W. Child & Co†	
J. W. Gaskill & Sons	$39.00
James Symington	35.50
Thomson C. Gill & Co	36.45
Rowland A. Robbins*	34.97
C. W. & H. W. Middleton	38.25
1,500 steel angle plates:	
J. W. Gaskill & Sons	.03
James Symington	.0250
Thomson C. Gill & Co*	.0220
Rowland A. Robbins	.0297
3,200 track-bolts, with Harvey's nut-lock:	
J. W. Gaskill & Sons	.0350
James Symington	.0325
Thomson C. Gill & Co*	.0430
Rowland A. Robbins	.0374

* Contract awarded. † Proposal informal.

10,500 pounds track-spikes:		
J. W. Gaskill & Sons		$0.0250
James Symington		.0225
Thomson C. Gill & Co*		.0230
Rowland A. Robbins		.0247
Tredegar Company		.0230
5 split steel switches:		
J. W. Gaskill & Sons*		33.00
James Symington		39.50
Thomson C. Gill & Co		37.00
Rowland A. Robbins		33.40
C. W. & H. W. Middleton		34.00
5 steel frogs:		
J. W. Gaskill & Sons*	3 No. 8	23.00
	2 No. 6	20.00
James Symington	No. 8	29.00
	No. 6	25.00
Thomson C. Gill & Co	No. 8	26.00
	No. 6	24.00
Rowland A. Robbins	No. 8	22.00
	No. 6	22.00
C. W. & H. W. Middleton	No. 8	25.00
	No. 6	23.00
5 ground lever switch-stands:		
J. W. Gaskill & Sons		4.60
James Symington		395.00
Thomson C. Gill & Co		7.00
Rowland A. Robbins*		4.20
C. W. & H. W. Middleton		5.00
5,700 creosoted yellow-pine ties:		
J. W. Gaskill & Sons		5,013.00
Rowland A. Robbins		5,844.60
Samuel D. Puller*		4,464.60
Carolina Oil and Creosote Company†		4,372.19
A. A. McCullough		5,347.60
Frank T. Wycoff		6,599.25
Creosote Lumber and Construction Company		5,415.00
Trant & Bro		4,503.00
Railroad tools:		
J. W. Gaskill & Sons		256.00
Rowland A. Robbins		195.26
James W. Soper*		186.74
Lumber for engine-house:		
J. W. Gaskill and Sons		511.76
A. A. McCullough*		504.85
R. J. Neely & Co		512.08
Trant & Bro		611.62
1,000 tons anthracite coal, broken:		
David Duncan & Son*		3.95
G. W. Taylor & Co		4.14
23,806 pounds domestic wire rigging:		
Rowland A. Robbins*		1,295.05

Schedule of proposals for coal and rigging supplies for navy-yard, Boston, received by Bureau of Provisions and Clothing, under advertisement dated April 21, 1888.

1,000 tons anthracite coal, broken:	
David Duncan & Son*	$4.65
David S. Wells	4.87
Meeker, Payne & Co	4.74
500 yards sheeting, Pequot Mills:	
Putnam & Foley*	.2250
Rowland A. Robbins	.2440
10 gallons spirits turpentine:	
Putnam & Foley	.50
Rowland A Robbins*	.48

*Contract awarded. †Bid informal.

40 gallons linseed oil:	
Putnam & Foley*	$0.67
Rowland A. Robbins	.69
20 gallons asphaltum:	
Putnam & Foley*	.83
40 gallons tar oil:	
Putnam & Foley*	.18
300 yards flax parceling:	
Putnam & Foley*	.10
Rowland A. Robbins	.1340
1 metallic tape line, Chesterman's:	
Putnam & Foley*	3.25
Rowland A. Robbins	10.40
12 sewing palms:	
Putnam & Foley	18.00
Rowland A. Robbins*	17.40
2 shoe knives:	
Putnam & Foley*	.12
Rowland A. Robbins	.20
500 ash rungs:	
Putnam & Foley	.13
Rowland A. Robbins*	.0690
350 wire thimbles:	
Walton Manufacturing Company†	.032
Putnam & Foley	.07½
Rowland A. Robbins*	.0690
275 rope thimbles:	
Putnam & Foley*	.0420
Rowland A. Robbins	.19
2,000 linen shipping-tags:	
Putnam & Foley*	3.50
4 sides bellows-leather:	
Putnam & Foley*	14.28
Rowland A. Robbins	20.60
12 paint brushes:	
Rowland A. Robbins*	20.90
12 scotchmans:	
Walton Manufacturing Company†	18.00
75 iron hanks:	
Putnam & Foley*	.46
150 sister hooks and thimbles:	
Walton Manufacturing Company†	1.44
Rowland A. Robbins* ....per pound	.23
100 wind-sail hoops:	
Putnam & Foley	.81
Rowland A. Robbins*	.64
7,240 pounds wire:	
Rowland A. Robbins*	.0570
12 gross grommet rings:	
Walton Manufacturing Company†	.30
Putnam & Foley	.74
Rowland A. Robbins*	.45
200 pounds beeswax:	
Putnam & Foley*	.30
Rowland A. Robbins	.31

Schedule of proposals for provisions, etc., for issue at navy-yard, New York, received by Bureau Provisions and Clothing, under advertisement dated May 12, 1888.

45,000 pounds bacon:	
Thurber, Whyland & Co.	$0.1261
Edward B. Hosier	.132
Francis H. Leggett & Co.*	.1125
30,000 pounds sausage:	
Edward B. Hosier*	.1098
Kemp, Day & Co.	.12
Francis H. Leggett & Co.	.12

* Contract awarded. † Bid irregular.

12,000 pounds codfish:	
Edward B. Hosier*	$0.0822
Kemp, Day & Co	.0825
Francis H. Leggett & Co	.08¼
12,000 pounds cornmeal:	
Edward B. Hosier	.0323
Kemp, Day & Co	.039
Francis H. Leggett & Co.*	.03
20,000 pounds oatmeal:	
Edward B. Hosier	.0494
Kemp, Day & Co	.055
Francis H. Leggett & Co.*	.0475
8,000 pounds rye flour:	
Edward B. Hosier	.0376
Kemp, Day & Co	.0425
Francis H. Leggett & Co.*	.035
10,000 pounds hominy:	
Edward B. Hosier	.038
Kemp, Day & Co	.0435
Francis H. Leggett & Co.*	.03¼
9,500 pounds cocoa:	
Runkel Bros	.2488
Henry Milliard	.27
Henry McCobb	.2549
Thurber, Whyland & Co	.3122
Green & Blackwell*	.24¼
Francis H. Leggett & Co	.25
750 pounds prunes:	
Thurber, Whyland & Co.*	.0425
Edward B. Hosier	.0716
Kemp, Day & Co	.065
Francis H. Leggett & Co	.08
1,000 pounds raisins:	
Thurber, Whyland & Co	.13
Kemp, Day & Co*	.115
Francis H. Leggett & Co	.13
750 pound figs:	
Thurber, Whyland & Co	.13
Kemp, Day & Co	.12
Francis H. Leggett & Co.*	.12
750 pounds currants:	
Thurber, Whyland & Co.*	.0671
Edward B. Hosier	.0949
Francis H. Leggett & Co	.11
1,500 pounds mutton:	
Edward B. Hosier	.086
Kemp, Day & Co	.10
Francis H. Leggett & Co.*	.065
30,000 pounds corn beef:	
Thurber, Whyland & Co	.0888
Kemp, Day & Co	.089
Francis H. Leggett & Co.*	.0853
Burt R. Scannell	.08¼
30,000 pounds ham (per dozen cans):	
Burt R. Scannell*	6.85
20,000 pounds butter:	
The Elgin Butter Company	.30
Higbie, Smith & Co.*	.2632
Simpson, McIntyre & Co	.2695
5,000 pounds tea:	
Thurber, Whyland & Co	.31
Francis H. Leggett & Co	.38
John G. Mars*	.23
250,000 pounds sugar:	
Thurber, Whyland & Co	.0722
James R. Michael	.0719
Francis H. Leggett & Co.*	.06865

*Contract awarded.

170,000 pounds fresh beef:	
Peter Morrison	$0.08
James J. Lyons	.076
John Hanley*	.06$\frac{5}{8}$
130,000 pounds fresh bread:	
Anton Behlan*	.025
John McNamara	.0325
260,000 pounds biscuit:	
John D. Gilmor	.045
The Treadwell & Harris Baking Company	.0397
Charles T. Goodwin*	.0366
15,000 pound pickles:	
E. H. Le Cour*	.069
F. Foehrenbach & Co	.07
Kemp, Day & Co	.0725
19,600 pounds wheat flour:	
Francis H. Leggett & Co.*	.025
Charles T. Goodwin	.0285$\frac{1}{4}$
170,000 pounds fresh vegetables:	
Peter Morrison	.02
James J. Lyons	.015
John Hanley*	.00$\frac{7}{8}$
64,765 pounds ice:	
Knickerbocker Ice Company*	.40
W. J. Belford	.50

Schedule of proposals for provisions, etc., for issue at navy-yard, Norfolk, received by Bureau Provisions and Clothing, under advertisement dated May 12, 1888, opened June 5, 1888.

83,000 pounds fresh beef:	
James Q. Anderson	$0.085
Samuel Westheimer	.091
Louis Wasserman	.0856
Isaac Gutman*	.0824
83,000 pounds fresh vegetables:	
Samuel Westheimer	.0365
Louis Wasserman	.0240
Isaac Gutman*	.03
70,000 pounds fresh bread:	
C. T. Cabler*	.03
80,000 pounds biscuit:	
John D. Gilmor	.04$\frac{5}{8}$
Charles T. Goodwin*	.04
240,000 gallons fresh water:	
William Clarke*	.0075
47,245 pounds ice:	
John K. Gann*	.75
Iron roofing:	
P. Ketcham & Co.*	12,000.00
King Iron Bridge and Manufacturing Company	13,994.00
Bartlett, Hayward & Co	15,500.00
Snead & Co. Iron Works	15,850.00

Schedule of proposals for provisions, etc., for issue at navy-yard, Boston, received by Bureau Provisions and Clothing, under advertisement dated May 12, 1888, opened June 5, 1888.

Charles A. Simonds:	
40,000 pounds fresh beef*	$0.06
40,000 pounds fresh vegetables*	.01
Michael J. Doran:	
40,000 pounds fresh beef	.06
40,000 pounds fresh vegetables	.015

* Contract awarded.

Rowland A. Robbins:

2,782 pounds G. A. steel wire*	$0.087
200 pounds red lead*	.071
5 gallons spirits turpentine*	.48
20 gallons linseed oil, boiled*	.68
10 gallons asphaltum*	.64
40 gallons tar oil*	.19
200 yards sheeting, D. W. cotton*	.21
100 yards black parceling*	.10
200 pounds rigging leather*	.355
6 paint brushes*	1.70
1 metallic tape line, Chesterman's*	3.15
2 shoe knives*	.20
500 rungs for Jacob's ladder*	.10
50 single hooks, one-half inch*	.09
150 sister hooks*	.19
350 wire thimbles*	.07
168 pounds sheet-iron*	.15
3,068 pounds sheet-copper*	.2499
90 pounds Banca tin*	.33
P. F. McDonald:	
6,000 pounds wrought-iron plates*	.03
1,024 pounds angle and bar iron*	.03

Proposal for ice for navy-yard, League Island, received by Bureau of Provisions and Clothing, under advertisement dated May 12, 1888, opened June 5, 1888.

Knickerbocker Ice Co., 60,175 pounds ice*	0.40

Schedule of proposals for fresh beef, vegetables, and ice, for issue at U. S. Naval Academy, received by Bureau of Provisions and Clothing, under advertisement dated May 19, 1888, opened June 12, 1888.

10,000 pounds fresh beef:	
John Kealy†	$0.0875
Jackson Brewer*	.08
10,000 pounds fresh vegetables:	
John Kealy†	.0275
Jackson Brewer*	.04
134,000 pounds ice:	
Joseph S. M. Basil*	.1850
10,000 pounds fresh bread:	
Martin M. Smith†	.0350

Schedule of proposals for fresh beef, vegetables, ice, etc., for issue at navy-yard, Mare Island, received by Bureau of Provisions and Clothing, under advertisement dated May 19, 1888, opened June 12, 1888.

50,000 pounds fresh beef:	
J. F. Tobin	$0.0875
Jacob Stutz*	.0850
50,000 pounds fresh vegetables:	
J. F. Tobin	.0275
Jacob Stutz*	.01
40,000 pounds fresh bread:	
D. T. Brown, jr.*	.04
Wolff & Boss	.04
75,000 pounds biscuit:	
American Biscuit Co.‡	.0549
22,000 pounds ice:	
Henry Connolly*	.03

* Contract awarded. † Proposal informal. ‡ Excessive; bid rejected.

Schedule of proposals for fresh water, beef, vegetables, and bread, for issue at United States Training Station, received by Bureau of Provisions and Clothing, under advertisement dated May 19, 1888, *opened June* 12, 1888.

180,000 gallons fresh water:	
Lawton Coggeshall*	$0.0050
30,000 pounds fresh beef:	
William S. Bailey	.1275
J. B. De Blois & Son	.13
Thomas Gladding & Son	.1250
John T. Reagan*	.0750
30,000 pounds fresh vegetables:	
Lawton Coggeshall	.03
William S. Bailey	.0325
John T. Reagan*	.0250
30,000 pounds fresh bread:	
Simeon Davis	.0350
R. W. Franklin	.0350
J. J. Lynch*	.0325

Schedule of proposals for fresh beef, vegetables, and bread, for issue at navy-yard, Portsmouth, N. H., received by Bureau of Provisions and Clothing, under advertisement dated May 19, 1888, *opened June* 12, 1888.

16,000 pounds fresh beef:	
Clarence M. Prince*	$0.0875
Herman R. Paul	.0950
16,000 pounds fresh vegetables:	
Clarence M. Prince*	.02
Herman R. Paul	.02
13,000 pounds fresh bread:	
Clarence M. Prince*	.06
Herman R. Paul	.06

* Contract awarded.

Schedule of proposals for fresh beef, vegetables, ice, file-boxes, for navy-yard, Washington, received by Bureau of Provisions and Clothing, under advertisement dated May 19, 1888, opened June 12, 1888.

6,000 pounds fresh beef:	
Charles C. Carroll *	$0.0424
F. G. Alexander †	.05
S. L. Hoover	.14
6,000 pounds fresh vegetables:	
Charles C. Carroll *	.0250
F. G. Alexander †	.0150
S. L. Hoover	.05
40,195 pounds ice:	
Independent Ice Company †	.40
Great Falls Ice Company	.50
National document file boxes, with suspension:	
Gore, Janney & Co. †	1.10
National document file-boxes, without suspension:	
Gore, Janney & Co. †	.80

Schedule of proposals for rope-wheels, etc., for navy-yard, Washington, received by Bureau of Provisions and Clothing, under advertisement dated May 26, 1888, opened June 19, 1888.

Rope-wheels, etc.:	
George C. Howard †	$6,203.60
C. Rittenhouse	6,695.72
John Cooper	6,345.60

Schedule of proposals for iron, lumber, paints, etc., for navy-yard, Mare Island, received by the Bureau of Provisions and Clothing, under advertisement dated June 2, 1888, opened June 26, 1888.

William Walker:	
Cedar †	$90.00
2-inch white oak †	110.00
5-inch white oak †	130.00
Cherry †	155.00
Pine †	80.00
Redwood †	45.00
Black walnut †	195.00
Oregon pine †	30.90
White ash †	105.00
Oregon pine logs †	29.50
A. Powell: †	
Cedar	92.50
2-inch white oak	175.00
5-inch white oak	200.00
Cherry	200.00
Pine	92.50
Redwood	40.00
Black walnut	250.00
Oregon pine	60.00
White ash	170.00
Oregon pine logs	55.00
James McCudden:	
Cedar	100.00
2-inch white oak	160.00
5-inch white oak	200.00
Cherry	200.00
Pine	100.00

* Informal. † Contract awarded.

James McCudden—Continued.	
Redwood	$45.00
Black walnut	230.00
Oregon pine	65.00
White ash	155.00
Oregon pine logs	60.00
Austin & Phelps:	
13,000 pounds round iron, size 1/8 to 3/8*	.0280
Rubber bands for band-saw wheels*	7.50
Round-head upholsterers' nails*	1.00
Galvanized iron*	.07
Muriatic acid*	.06
Cotton wicking	.25
Pump leather, 3 sides*	.35
Enameled ship's leather*	.25
Swedish iron upholsterer's tacks	5.00
Sheet lead*	.0825
26 woven-wire mattresses*	2.25
7-inch deck spikes*	45.00
6-inch deck spikes*	45.00
5-inch deck spikes*	45.00
Angle iron*	.04
Flange iron*	.06
Rivets	45.00
2 bars steel	.11
Rubber	.45
Sheet gum	.70
7 dozen elbows	47.80
7 dozen couplings	108.00
7 dozen tees	57.60
7 dozen crosses	66.00
7 dozen caps	27.60
7 dozen return couplings	105.60
Nipples	25.80
Plugs	17.90
6 crucibles*	11.70
Steam-pipe	93.50
Lace leather, 4 skins	$16.80
200 feet brass tubing*	110.00
1 dozen machinists' hammers	11.00
150 feet rubber hose	.28
6 dozen iron bolts	3.00
Albert Gallatin:	
13,000 pounds round iron, size 1/4 to 3/8*	.0260
13,000 pounds round iron, size 1/16 to 3/8	.0285
Cotton wicking*	.17
Swedish iron upholsterers' tacks*	2.63
7-inch deck spikes	48.70
6-inch deck spikes	48.70
5-inch deck spikes	48.70
Rivets*	28.00
2 bars steel*	.0950
Rubber*	.1650
Sheet gum*	.4350
7 dozen elbows*	46.41
7 dozen couplings*	106.68
7 dozen tees*	55.23
7 dozen crosses*	65.66
7 dozen caps*	26.53
7 dozen return couplings*	103.25
Nipples*	24.57
Plugs*	17.01
Steam-pipe*	88.50
Lace leather, 4 skins*	9.00
1 dozen machinists' hammers*	8.00
150 feet rubber hose*	.1625
6 dozen iron bolts*	1.74

* Contract awarded.

Merry, Faull & Co.:	
15,000 pounds canned roast beef*	$0.0[illegible]
15,000 pounds canned corn beef*	.0[illegible]

Schedule of proposals for coal for navy-yard, Washington, received by the Bureau of Provisions and Clothing, under advertisement dated June 2, 1888, opened June 26, 1888.

500 tons Cumberland coal:	
Stevenson & Bro.*	$2.9[illegible]
John Miller	3.[illegible]
Johnson Bros	2.93

* Contract awarded.

APPENDIX K.

Statement of contracts made by the Bureau of Provisions and Clothing for and in behalf of the Navy Department during fiscal year ending June 30, 1888.

Name.	Date.	Article contracted for.		Quantity.	Price.	Amount.	Where delivered.
	1887.						
American Biscuit Co., San Francisco, Cal.	June 21	Navy bread	pounds.	25,000	$1.49 per 100 pounds	$1,122.50	Mare Island, California.
John F. Tobin, Vallejo, Cal.	June 21	Fresh beef	do.	22,000	7¼ cents per pound	2,368.00	Do.
Do.	June 21	Vegetables	do.	32,000	2½ cents per pound	860.00	Do.
John Faust, Vallejo, Cal.	June 21	Fresh bread	do.	25,000	3 cents per pound	750.00	Do.
John S. Bell, Warrington, Fla.	June 21	Fresh beef	do.	1,000	15 cents per pound	150.00	Pensacola, Fla.
Do.	June 21	Vegetables	do.	1,000	7 cents per pound	70.00	Do.
Moses White, Warrington, Fla.	June 21	Fresh bread	do.	800	5½ cents per pound	44.00	Do.
Jeremiah O'Neal, Woolsey, Fla.	June 21	Navy bread	do.	1,000	4 cents per pound	40.00	Do.
Herman R. Paul, Kittery, Me.	June 25	Vegetables	do.	16,000	2 cents per pound	320.00	Portsmouth, N. H.
Clarence M. Prince, Kittery, Me.	June 25	Fresh beef	do.	16,000	9¾ cents per pound	1,560.00	Do.
John O. Downs & Co., Portsmouth, N. H.	June 25	Fresh bread	do.	13,000	6 cents per pound	780.00	Do.
Austin & Graves, Boston, Mass.	June 25	do.	do.	21,946	do.	1,316.76	Boston, Mass.
Charles A. Simonds, Boston, Mass.	June 25	Fresh beef	do.	40,049	10½ cents per pound	5,206.37	Do.
Do.	June 25	Vegetables	do.	40,049	2½ cents per pound		Do.
Drivers' Union Ice Co., Boston, Mass.	June 25	Ice	do.	28,080	36 cents per 100 pounds	101.08	Do.
William S. Bailey, Newport, R. I.	June 25	Vegetables	do.	10,000	1½ cents per pound	150.00	Newport, R. I.
Jeremiah J. Lynch, Newport, R. I.	June 25	Fresh bread	do.	40,000	3¾ cents per pound	1,500.00	Do.
Thomas Gladding & Son, Newport, R. I.	June 25	Fresh beef	do.	10,000	8½ cents per pound	850.00	Do.
Lawton Coggeshall, Newport, R. I.	June 25	Fresh water	gallons.	60,000	½ cent per gallon	300.00	Do.
Knickerbocker Ice Co., New York, N. Y.	June 25	Ice	pounds.	63,000	15 cents per 100 pounds	94.50	New York, N. Y.
John D. Gilmor, Brooklyn, N. Y.	June 25	Bake, from flour furnished	do.	260,542	$1.40½ per barrel	1,867.67	Do.
Anton Behlen, Brooklyn, N. Y.	June 25	Fresh bread	do.	115,868	2½ cents per pound	2,896.70	Do.
John Hanley, Brooklyn, N. Y.	June 25	Fresh beef	do.	121,509	5$\frac{8}{10}$ cents per pound	8,019.59	Do.
Do.	June 25	Vegetables	do.	121,509	$\frac{8}{10}$ cent per pound		Do.
Knickerbocker Ice Co., Philadelphia, Pa.	June 25	Ice	do.	51,645	40 cents per 100 pounds	206.58	League Island, Pa.
William Schabinger, Philadelphia, Pa.	June 25	Fresh bread	do.	5,200	4½ cents per pound	234.00	Do.
L. Shuster Boraef, Philadelphia, Pa.	June 25	Fresh beef	do.	6,500	10½ cents per pound	942.50	Do.
Do.	June 25	Vegetables	do.	6,500	4 cents per pound		Do.
Charles E. Koller, Washington, D. C.	June 25	Fresh bread	do.	6,400	3$\frac{38}{100}$ cents per pound	216.32	Washington, D. C.
Joseph S. M. Basil, Annapolis, Md.	June 25	Ice	do.	134,400	22 cents per 100 pounds	295.68	Annapolis, Md.
John K. Gann, Portsmouth, Va.	June 25	do.	do.	47,000	70 cents per 100 pounds	329.00	Norfolk, Va.
Louis Wasserman, Norfolk, Va.	June 25	Fresh beef	do.	84,000	5$\frac{10}{100}$ cents per pound	5,418.00	Do.
Do.	June 25	Vegetables	do.	84,000	1$\frac{35}{100}$ cents per pound		Do.
William Clark, Berkeley, Va.	June 25	Fresh water	do.	240,000	¾ cent per gallon	1,800.00	Do.
J. Q. Anderson, Portsmouth, Va.	June 25	Fresh bread	do.	71,000	3⅞ cents per pound	2,751.25	Do.
E. E. Saunders & Co., Pensacola, Fla.	June 25	Ice	do.	40,320	¾ cent per pound	302.40	Pensacola, Fla.
A. F. Tift, Key West, Fla.	June 25	do.	do.	7,300	1 cent per pound	73.00	Key West, Fla.
Henry Connolly, Vallejo, Cal.	June 25	do.	do.	19,500	3 cents per pound	585.00	Mare Island, California.
Rowland A. Robbins, New York, N. Y.	June 30	Bleached duck	yards.	25,000	22$\frac{87}{100}$ cents per yard	6,023.00	New York, N. Y.
Do.	June 30	Burlaps	do.	5,000	5$\frac{11}{100}$ cents per yard		Do.

Statement of contracts made by the Bureau of Provisions and Clothing for and in behalf of the Navy Department, etc.—Continued.

Name.	Date.	Article contracted for.	Quantity	Price.	Amount.	Where delivered.
	1887.					
Richard W. Creed, New York, N. Y.	June 30	Enameled cloth ... yards.	3,100	25½ per cents per yard	$891.25	New York, N. Y.
Do	June 30	Gum camphor ... pounds.	500	25¼ cents per pound		Do.
John Kealy, Annapolis, Md	Aug. 12	Fresh beef, in indefinite quantities		8¼ cents per pound		Annapolis, Md.
Do	Aug. 12	Vegetables, in indefinite quantities		2 7/10 cents per 100 pounds		Do.
Martin M. Smith, Annapolis, Md	Aug. 12	Fresh bread, in indefinite quantities		3¼ cents per pound		Do.
James Reid & Co., Norfolk, Va	Aug. 13	Bake from flour furnished, in indefinite quantities.		$2 per barrel		Norfolk, Va.
William R. Thompson, Brooklyn, N. Y.	Aug. 19	Small stores			800.62	New York, N. Y.
Do	Aug. 19	Wood and willow-ware				Do.
William Porter's Sons, New York, N. Y	Aug. 19	Lamps and lanterns			1,137.92	Do.
Do	Aug. 19	do				Norfolk, Va.
George A. Hammond, Eliot, Me	Aug. 19	Lumber and timber			1,000.50	Boston, Mass.
Manhattan Oil Co., New York, N. Y	Aug. 19	Oil, lubricating and illuminating			489.83	Do.
George A. Hammond, Eliot, Me	Aug. 19	Provender			2,018.45	Portsmouth, N. H.
John Swann & Co., New York, N. Y	Aug. 19	Cordage			1,255.70	Do.
Do	Aug. 19	Equipment and fittings ship and boat				Do.
Do	Aug. 19	Fuel				Do.
Do	Aug. 19	Naval stores				Do.
Do	Aug. 19	Engineers' supplies				Do.
Manhattan Oil Co., New York, N. Y	Aug. 19	Oils, lubricating and illuminating			1,580.28	Do.
J. W. Gaskill & Sons, Philadelphia, Pa	Aug. 19	Lumber and timber			6,441.14	Do.
Do	Aug. 19	do				Washington, D. C.
Johnson Bros., Washington, D. C	Aug. 19	Fuel			2,892.43	Do.
Do	Aug. 19	do				Do.
Do	Aug. 19	do				Do.
J. B. Kendall, Washington, D. C	Aug. 19	Metals			7,105.02	Do.
Do	Aug. 19	Supplies, engineers'				Do.
T. Somerville & Sons, Washington, D. C	Aug. 19	Pipes, steam, gas, etc			317.07	Do.
Do	Aug. 19	Supplies, plumbers'				Do.
Manhattan Oil Co., New York, N. Y	Aug. 19	Oils, lubricating and illuminating			349.60	Pensacola, Fla.
Gardiner B. Reynolds & Co., Newport, R. I.	Aug. 19	Fuel			4,447.50	Newport, R. I.
Do	Aug. 19	do				Do.
Manhattan Oil Co., New York, N. Y	Aug. 19	Oils, illuminating and lubricating			153.85	Annapolis, Md.
Gilmor Meredith & Co., Georgetown, D. C.	Aug. 19	Fuel			11,147.00	Do.
James J. Donovan, New York, N. Y	Aug. 20	Apparatus, etc., electric			1,513.48	New York, N. Y.
Do	Aug. 20	Fuel				Do.
Do	Aug. 20	do				Do.
Edw. B. Hosier, New York, N. Y	Aug. 20	Provisions			97.09	Do.
John W. Oast & Bro., Portsmouth, Va	Aug. 20	Fuel			113.75	Norfolk, Va.
E. J. Griffith & Co., Norfolk, Va	Aug. 20	Furniture, house			3,838.67	Do.
Do	Aug. 20	Tools and hardware				Do.
Do	Aug. 20	Wood and willow ware				Do.
William B. Price Manufacturing Co., Baltimore, Md.	Aug. 20	Chemicals, drugs, etc			882.00	Boston, Mass.

Z. D. Gilman, Washington, D. C	Aug. 20	Naval stores		34.20	Washington, D. C.
Elias Pohl, Philadelphia	Aug. 20	Lumber and timber		978.00	League Island, Pa.
Avery & Woolfolk, Pensacola, Fla	Aug. 20	Wood and willow-ware		9.00	Pensacola, Fla.
Joseph S. M. Basil, Annapolis, Md	Aug. 20	Fuel		1,460.25	Annapolis, Md.
Z. D. Gilman, Washington, D. C	Aug. 20	Apparatus, etc., photographic		320.90	Do.
Do	Aug. 20	Chemicals, drugs, etc			Do.
John Moonan, New York, N. Y	Aug. 22	Provender		2,346.00	New York, N. Y.
Joseph W. Duryee, New York, N. Y	Aug. 22	Lumber and timber		37,484.50	Do.
David Duncan & Son, New York, N. Y	Aug. 22	Fuel		36,136.04	Do.
Do	Aug. 22	do			Do.
Thurber, Whyland & Co., New York, N. Y	Aug. 22	Coffee ... pounds	100,000 $19.97 per 100 pounds	19,970.00	Do.
William B. Price Manufacturing Co., Baltimore, Md	Aug. 22	Chemicals, drugs, etc		6,155.55	Norfolk, Va.
S. C. Forsaith Machine Co., Manchester, N. H.	Aug. 22	Machinery and machine-tools		1,293.05	Do.
A. A. McCullough & Co., Norfolk, Va	Aug. 22	Building materials		6,833.65	Do.
Do	Aug. 22	Fuel			Do.
Do	Aug. 22	Oyster-shells			Do.
E. V. White & Co., Norfolk, Va	Aug. 22	Fittings, boiler and engine		407.57	Do.
George L. Neville, Portsmouth, Va	Aug. 22	Brushes		1,134.85	Boston, Mass.
Do	Aug. 22	Fittings, boiler and engine			Do.
Do	Aug. 22	Naval stores			Do.
David Duncan & Son, New York, N. Y	Aug. 22	Fuel		14,881.10	Do.
Do	Aug. 22	do			Do.
William B. Price Manufacturing Co., Baltimore, Md.	Aug. 22	Chemicals, drugs, etc		1,298.63	Portsmouth, N. H
S. C. Forsaith Machine Co., Manchester, N. H.	Aug. 22	Machinery and machine-tools		882.60	Do.
Rider & Cotton, Portsmouth, N. H	Aug. 22	Brushes		6,623.87	Do.
Do	Aug. 22	Building materials			Do.
Do	Aug. 22	Dry goods			Do.
Do	Aug. 22	Fittings, boiler and engine			Do.
Do	Aug. 22	Furniture, house			Do.
Do	Aug. 22	Instruments and apparatus, measuring and weighing.			Do.
Do	Aug. 22	Lamps and lanterns			Do.
Do	Aug. 22	Metals			Do.
Do	Aug. 22	Pipe, steam, gas, etc			Do.
Do	Aug. 22	Provisions			Do.
Do	Aug. 22	Supplies, plumbers'			Do.
Do	Aug. 22	Tools and hardware			Do.
Do	Aug. 22	Wood and willow-ware			Do.
Do	Aug. 22	Harness soap, etc			Do.
James W. Soper, New York, N. Y	Aug. 22	Ship chandlery		167.52	Do.
George L. Neville, Portsmouth, Va	Aug. 22	Leather, rubber, and belting		980.00	Do.
David Duncan & Son, New York, N. Y	Aug. 22	Fuel		10,680.00	Do.
Do	Aug. 22	do			Do.
Brooks Oil Co., Cleveland, Ohio	Aug. 22	Oils, lubricating and illuminating		984.05	Washington, D. C.
William B. Price Manufacturing Co., Baltimore, Md.	Aug. 22	Chemicals, drugs, etc		338.65	Do.
John Wanamaker, Philadelphia, Pa	Aug. 22	Stationery		2,653.83	Do.
Do	Aug. 22	do			Do.

[illegible] contracts made by the Bureau of Provisions and Clothing for and in behalf of the Navy Department, etc.—Continued.

Name.	Date.	Articles contracted for.	Quantity.	Price.	Amount.	Place of delivery.
[illegible]	Aug. [illegible]	[illegible]				Washington, D.C.
	Aug. [illegible]	[illegible] material			[illegible]	Do.
	Aug. [illegible]	[illegible]				Do.
[illegible]	Aug. [illegible]	[illegible]			55.7[illegible]	League Island, Pa.
[illegible]	Aug. [illegible]	[illegible]				Do.
	Aug. [illegible]	[illegible]				Do.
	Aug. [illegible]	[illegible]				Do.
	Aug. [illegible]	Dry goods			262.[illegible]	Do.
	Aug. [illegible]	Leather, rubber, and belting				Do.
	Aug. [illegible]	[illegible]				Do.
[illegible]	Aug. [illegible]	Fuel			3,[illegible].39	Do.
[illegible]	Aug. [illegible]	Brick				Pensacola, Fla.
Do.	Aug. [illegible]	Lumber and timber			4[illegible].40	Do.
Do.	Aug. [illegible]	Food and bread [illegible]				Do.
[illegible]	Aug. [illegible]	[illegible]			541.06	Do.
[illegible]	Aug. [illegible]	Food and bread [illegible]			51.81	Newport, R.I.
[illegible]	Aug. [illegible]	Apparatus for [illegible]			5,577.51	New York, N.Y.
Do.	Aug. [illegible]	Furniture [illegible]				Do.
[illegible]	Aug. [illegible]	Apparatus [illegible]			2,500.20	Norfolk, Va.
[illegible]	Aug. [illegible]	[illegible] complete			46.51	Do.
[illegible]	Aug. [illegible]	Fuel			4,435.00	Do.
[illegible]	Aug. [illegible]	Furniture, cutlery, and kitchen [illegible]			1,041.52	Do.
[illegible]	Aug. [illegible]	Apparatus [illegible]			55.00	Boston, Mass.
Do.	Aug. [illegible]	[illegible]			107.20	Portsmouth, N.H.
[illegible]	Aug. [illegible]	[illegible]			507.10	League Island, Pa.
[illegible]	Aug. [illegible]	[illegible]			[illegible]	Do.
[illegible]	Aug. [illegible]	[illegible]			[illegible]	Pensacola, Fla.
Do.	Aug. [illegible]	[illegible]			[illegible]	New York, N.Y.
Do.	Aug. [illegible]	[illegible]				Norfolk, Va.
Do.	Aug. [illegible]	[illegible]				Do.
Do.	Aug. [illegible]	[illegible]			[illegible]	Do.
Do.	Aug. [illegible]	[illegible]				Do.
Do.	Aug. [illegible]	[illegible]				Do.
John Mulford [illegible]	Aug. 2[illegible]	[illegible]				Boston, Mass.
Do.	Aug. 2[illegible]	[illegible]			1,[illegible]	Do.
Do.	Aug. 25	Soap				Do.
Rowland & Robbins, New York, N.Y.	Aug. 25	Canvas				Washington, D.C.
Do.	Aug. 25	Dry goods				Do.
Do.	Aug. 25	Leather, rubber and belting				Do.
Do.	Aug. 25	Ship chandlery			1[illegible]	Do.

Do	Aug. 25	Small stores				Do.
Do	Aug. 25	Stationery 1				Do.
Do	Aug. 25	Stationery 4				Do.
Do	Aug. 25	Stationery 5				Do.
Paul J. Field, Philadelphia, Pa	Aug. 25	Lamps and lanterns			8.75	League Island, Pa.
Charles J. Field, Philadelphia, Pa	Aug. 25	Building material				Do.
Do	Aug. 25	Cordage				Do.
Do	Aug. 25	Instruments and apparatus, mathematical and philosophical.				Do.
Do	Aug. 25	Supplies, engineers'			290.23	Do.
Do	Aug. 25	Supplies, plumbers'				Do.
Do	Aug. 25	Tools and hardware				Do.
Do	Aug. 25	Wood and willow ware				Do.
Gardner L. Reynolds & Co., Newport, R. I	Aug. 25	Fuel, chestnut coal .... tons..	100	$4.[illegible] per ton	6,525.00	Newport, R. I.
Do	Aug. 25	Fuel, broken white ash ....do ..	1,[illegible]00	$4.65 per ton		Do.
Rowland A. Robbins, New York, N. Y	Aug. 25	Brushes				Annapolis, Md.
Do	Aug. 25	Building material				Do.
Do	Aug. 25	Instruments and apparatus, mathematical and philosophical.				Do.
Do	Aug. 25	Leather, rubber, and belting			336.41	Do.
Do	Aug. 25	Metals				Do.
Do	Aug. 25	Small stores				Do.
Do	Aug. 25	Supplies, engineers'				Do.
Do	Aug. 25	Wood and willow ware				Do.
Do	Aug. 25	Soap, laundry				Do.
Evans, Burwell & Tazwell, Norfolk, Va	Aug. 26	Provender			1,125.20	Norfolk, Va.
Mayer & Co., Norfolk, Va	Aug. 26	Instruments and apparatus, mathematical and philosophical.				Do.
Do	Aug. 26	Pipe, steam, gas, etc			2,230.42	Do.
Do	Aug. 26	Harness and fittings				Do.
McKenzie, Oerting & Co., Warrington, Fla	Aug. 26	Dry goods				Pensacola, Fla.
Do	Aug. 26	Lamps and lanterns				Do.
Do	Aug. 26	Metals			858.65	Do.
Do	Aug. 26	Naval stores				Do.
Do	Aug. 26	Bran, oats, hay, etc				Do.
Rowland A. Robbins, New York, N. Y	Aug. 27	Brushes				New York, N. Y.
Do	Aug. 27	Building material				Do.
Do	Aug. 27	Canvas				Do.
Do	Aug. 27	Chemicals, drugs, etc				Do.
Do	Aug. 27	Dry goods				Do.
Do	Aug. 27	Equipments and fittings, ship and boat				Do.
Do	Aug. 27	Fittings, boiler and engine				Do.
Do	Aug. 27	Galley and kitchen furniture				Do.
Do	Aug. 27	Table furniture				Do.
Do	Aug. 27	Instruments and apparatus, mathematical and philosophical.			83,218.10	Do.
Do	Aug. 27	Leather, rubber, and belting				Do.
Do	Aug. 27	Machinery and machine-tools				Do.
Do	Aug. 27	Metals				Do.
Do	Aug. 27	Naval stores				Do.
Do	Aug. 27	Pipe, steam, gas, etc				Do.
Do	Aug. 27	Ship chandlery				Do.

Statement of contracts made by the Bureau of Provisions and Clothing for and in behalf of the Navy Department, etc.—Continued.

Name.	Date.	Article contracted for.	Quantity.	Price.	Amount.	Where delivered.
	1887.					
Rowland A. Robbins, New York, N. Y.	Aug. 27	Engineers' supplies				New York, N. Y.
Do	Aug. 27	Plumbers' supplies				Do.
Do	Aug. 27	Tools and hardware				Do.
Do	Aug. 27	Miscellaneous No. 3, soap, matches, etc				Do.
George L. Neville, Portsmouth, Va.	Aug. 31	Metals				Norfolk, Va.
Do	Aug. 31	Apparatus and materials, electric				Do.
Do	Aug. 31	Cordage				Do.
Do	Aug. 31	Dry goods				Do.
Do	Aug. 31	Fuel				Do.
Do	Aug. 31	Furniture, table			$21,276.99	Do.
Do	Aug. 31	Leather, rubber, and belting				Do.
Do	Aug. 31	Lumber and timber				Do.
Do	Aug. 31	Naval stores				Do.
Do	Aug. 31	Machinery and machine tools				Do.
Do	Aug. 31	Steel dies				Do.
John Miller, Washington, D. C	Aug. 31	Fuel			2,217.80	Washington, D. C.
Charles F. Hodsdon, New York, N. Y	Sept. 1	Cypress and white cedar boards			2,052.00	New York, N. Y.
S. C. Forsaith Machine Co., Manchester, N. H.	Sept. 2	Machinery and machine tools			507.30	Washington, D. C.
Donegan & Swift, New York, N. Y	Sept. 2	Double cylinder drum hoisting engine			1,270.00	New York, N. Y.
James R. Michael, New York, N. Y	Sept. 2	Silk, twist, cotton, etc			1,455.60	Do.
J. Albert Walker, Portsmouth, N. H	Sept. 3	Fuel			40.00	Portsmouth, N. H.
Rider & Cotton, Portsmouth, N. H	Sept. 3	Oakum, pitch, mopyarn, white lead, and Japan drier.			783.10	Do.
Myers & Loving, Washington, D. C	Sept. [illegible]	Provender			1,108.20	Washington, D. C.
Brooks Oil Co., Cleveland, Ohio	Sept. [illegible]	Oils, lubricating and illuminating			3,991.86	Mare Island, Cal.
Charles M. Yates, San Francisco, Cal	Sept. 6	Brushes				Do.
Do	Sept. 6	Chemicals, drugs, etc			4,687.12	Do.
Do	Sept. 6	Lamps and lanterns				Do.
R. O. Edmonston, Washington, D. C	Sept. [illegible]	Provisions				Washington, D. C.
Do	Sept. 6	Wood and willow ware			89.08	Do.
Do	Sept. 6	Matches and soap				Do.
Richard W. Creed, New York, N. Y	Sept. 7	Charcoal, tin, solder, spikes, sheet-iron, etc.			178.00	New York, N. Y.
Albert Flagler, New York, N. Y	Sept. 7	Razors	1,000	24$\frac{83}{100}$ cents each	458.50	Do.
Do	Sept. [illegible]	Razor strops	1,000	24$\frac{35}{100}$ cents each		Do.
James S. Barron & Co., New York, N. Y	Sept. [illegible]	Wisp-brooms and shoe-brushes ....each	5,000	17$\frac{17}{100}$ cents w. b., 17$\frac{47}{100}$ cents s. b., each.	1,732.00	Do.
James R. Michael, New York, N. Y	Sept. 7	Black silk neckerchiefs	5,000	$1.19 each		Do.
Do	Sept. 7	Tape ....pieces	5,000	10 cents per dozen	6,141.67	Do.
Do	Sept. 7	Cotton ....spools	3,000	45 cents per dozen		Do.
William Wenrich Moyer, New York, N. Y	Sept. 7	Mattresses	2,500	$4.58 each	11,450.00	Do.
Richard W. Creed, New York, N. Y	Sept. 7	Shaving-brushes	1,000	8$\frac{3}{4}$ cents each		Do.
Do	Sept. 7	Scrub-brushes	3,000	11$\frac{3}{4}$ cents each	780.00	Do.
Do	Sept. 7	Padlocks	500	68 cents each		Do.

Peter H. McNulty, Brooklyn, N. Y	Sept. 7	Watch-caps	10,000	58 cents each	7,314.60	Do.
Do	Sept. 7	Silk ..... spools	28,000	$3\frac{11}{100}$ cents each		Do.
Do	Sept. 7	Thread ..... do	10,000	$3\frac{49}{100}$ cents each		Do.
Do	Sept. 7	Needles ..... papers	1,000	$4\frac{1}{2}$ cents each		Do.
San Francisco Pioneer Woolen Factory, San Francisco, Cal.	Sept. 7	Cloth for trousers ..... yards	10,000	2.18\frac{3}{4}$ per yard	21,875.00	Do.
Manhattan Oil Company, New York, N. Y	Sept. 7	Candles ..... pounds	50,000	$10\frac{1}{4}$ cents per pound	5,125.00	Do.
G. K. Sheridan & Co., New York, N. Y	Sept. 7	Unbleached cotton-duck ..... yards	35,000	$11\frac{73}{100}$ cents per yard	4,105.50	Do.
Chesebro Manufacturing Company, New York, N. Y.	Sept. 7	Shoe-blacking ..... boxes	10,000	$2\frac{1}{12}$ cents per box	208.34	Do.
Francis T. Witte Hardware Company, New York, N. Y.	Sept. 7	Spoons	5,000	$2\frac{1}{3}$ cents each	243.33	Do.
Do	Sept. 7	Forks	5,000	$2\frac{2}{3}$ cents each		Do.
B. Y. Pippey & Co., New York, N. Y	Sept. 7	Woolen socks ..... pairs	10,000	$34\frac{1}{4}$ cents per pair	3,425.00	Do.
J. Freeman & Co., Orange, N. J	Sept. 7	Calf shoes ..... do	9,000	$2.13 per pair	19,170.00	Do.
Alta Soap Company, San Francisco, Cal	Sept. 7	Salt-water soap ..... pounds	50,000	4 cents per pound	2,000.00	Mare Island, Cal.
Albert Gallatin, San Francisco, Cal	Sept. 7	Apparatus, fire, hose, etc			10,601.04	Do.
Do	Sept. 7	Instruments and apparatus, mathematical and philosophical.				Do.
Do	Sept. 7	Pipe, steam, gas, water, etc				Do.
Do	Sept. 7	Supplies, engineers'				Do.
Do	Sept. 7	Tools and hardware				Do.
M. Ehrman & Co., San Francisco, Cal	Sept. 7	Oat-meal ..... pounds	2,000	$5\frac{1}{10}$ cents per pound	8,082.00	Do.
Do	Sept. 7	Rice ..... do	3,000	$4\frac{1}{2}$ cents per pound		Do.
Do	Sept. 7	Pickles ..... do	4,000	do		Do.
Do	Sept. 7	Sugar ..... do	25,000	$6\frac{3}{4}$ cents per pound		Do.
Do	Sept. 7	Coffee ..... do	25,000	$23\frac{1}{2}$ cents per pound		Do.
Do	Sept. 7	Beans ..... gallons	1,000	24 cents per gallon		Do.
T. H. Dowling & Co., San Francisco, Cal	Sept. 7	Corn meal ..... pounds	2,000	$3\frac{13}{100}$ cents per pound	349.80	Do.
Do	Sept. 7	Tomatoes ..... do	2,000	$4\frac{3}{5}$ cents per pound		Do.
Do	Sept. 7	Vinegar ..... gallons	800	15 cents per gallon		Do.
Do	Sept. 7	Blacking ..... boxes	2,000	$3\frac{5}{10}$ cents per box		Do.
Manhattan Oil Co., New York, N. Y.	Sept. 7	Candles ..... pounds	20,000	$12\frac{1}{2}$ cents per pound	2,500.00	Do.
John Brownlie, Vallejo, Cal	Sept. 7	Tin pots	1,000	9 cents each	135.00	Do.
Do	Sept. 7	Tin pans	1,000	$4\frac{1}{2}$ cents each		Do.
Horace E. Wilder, Vallejo, Cal	Sept. 7	Mess kettles	100	76 cents each	76.00	Do.
W. W. Montague & Co., San Francisco, Cal	Sept. 7	Mess pans	100	44 cents each	44.00	Do.
M. S. Kelly, Vallejo, Cal	Sept. 7	Butter ..... pounds	3,000	28 cents per pound	980.00	Do.
Do	Sept. 7	Molasses ..... gallons	500	28 cents per gallon		Do.
John S. Howell, New York, N. Y	Sept. 8	Broken stone ..... cubic yards	7,500	78 cents per cubic yard	5,850.00	New York, N. Y.
Peter H. McNulty, Brooklyn, N. Y	Sept. 8	Wharf and cut spikes and round iron			1,419.86	Do.
William McKnight, Trenton, N. J	Sept. 8	Kip shoes ..... pairs	1,000	$2.15 per pair	2,150.00	Do.
Peter H. McNulty, Brooklyn, N. Y	Sept. 8	Blankets, jute roving, leather buttons, etc			12,509.35	Do.
Aden Brothers, Vallejo, Cal	Sept. 8	Fuel			768.00	Mare Island, Cal.
George W. Gibbs & Co., San Francisco, Cal	Sept. 9	Metals			8,096.15	Do.
Albert Hagler, New York, N. Y	Sept. 10	Roofing-slate, bricks, cement, and lime			1,214.40	New York, N. Y.
Dunham, Carrigan & Co., San Francisco, Cal.	Sept. 10	Fittings, boiler and engine			4,108.96	Mare Island, Cal
Do	Sept. 10	Machinery and machine tools				Do.
Do	Sept. 10	Plumbers' supplies				Do.

Statement of contracts made by the Bureau of Provisions and Clothing for and in behalf of the Navy Department, etc.—Continued.

Name.	Date.	Article contracted for.	Quantity.	Price.	Amount.	Where delivered.
	1887.					
Louis F. Lohe, San Francisco, Cal	Sept. 10	Canvas			$1,656.98	Mare Island, Cal.
Do	Sept. 10	Furniture, galley and kitchen				Do.
Do	Sept. 10	Furniture, house				Do.
Do	Sept. 10	Lines, chalk, matches, soap, etc				Do.
Albert Flagler, New York, N. Y	Sept. 10	Tools, engine lathes and machinery			3,016.16	Norfolk, Va.
J. W. G[illegible] & Sons, Philadelphia, Pa	Sept. 10	Yellow and white pine timber			8,451.00	Portsmouth, N. H.
J. A. Emerich & Co., Philadelphia, Pa	Sept. 12	Foundry cupola and fire-brick			660.00	Norfolk, Va.
James McCudden, Vallejo, Cal	Sept. 13	Building material			71,376.65	Mare Island, Cal.
Do	Sept. 13	Fuel				Do.
Do	Sept. 13	......do				Do.
Do	Sept. 13	......do				Do.
Do	Sept. 13	Lumber and timber				Do.
Do	Sept. 13	Stable provender				Do.
James G. Hup & Co., San Francisco, Cal	Sept. 14	Naval stores			1,524.96	Do.
Do	Sept. 14	Provisions				Do.
Do	Sept. 14	Ship chandlery				Do.
Do	Sept. 14	Small stores				Do.
Do	Sept. 14	Wood and willow ware				Do.
Thurber, Whyland & Co	Oct. 12	Canned roast beef ......pounds	50,000	7$\frac{2}{100}$ cents per pound	3,510.00	New York, N. Y.
Do	Oct. 12	Dried peaches ......do	10,000	28 cents per pound	2,800.00	Do.
Kemp, Day & Co., New York	Oct. 12	Canned ham ......pounds	30,000	13 cents per pound	3,900.00	Do.
Do	Oct. 12	Pickles ......do	25,000	7$\frac{3}{10}$ cents per pound	1,825.00	Do.
Edward B. Hosier, New York	Oct. 12	Beans ......gallons	10,093	28$\frac{1}{5}$ cents per gallon	2,841.00	Do.
Do	Oct. 12	Assorted vegetables ......pounds	75,000	6$\frac{21}{100}$ cents per pound	4,661.00	Do.
William H. Belford, New York	Oct. 12	Canned tomatoes ......do	50,000	3$\frac{3}{4}$ cents per pound	1,875.00	Do.
George B. Roberts, Boston	Oct. 25	Capstan engine			1,795.00	Portsmouth, N. H.
J. W. Bond & Co, Baltimore	Nov. 7	Stationery			127.45	U. S. S. *New Hampshire.*
William F. Wilbur, Newport	Nov. 8	Building improvements			1,100.00	Newport, R. I.
American Bank-note Co., New York	Nov. 17	Continuous-service certificates			1,680.00	Washington.
Robert M. Miller, Washington	Nov. 17	Sand ......barrels of 200 pounds each	6,825	12 cents per barrel	819.00	Do.
Merry, Faull & Co., San Francisco	Nov. 18	Prime mess pork ......barrels	125	$17 per barrel	4,437.50	Mare Island, Cal.
		......half-barrels	270	$9.25 per half-barrel		
Andrew Neville, Washington	Nov. 18	Broken stone..barrels of 200 pounds each	10,000	25 cents per barrel	2,500.00	Washington.
Berry & McFrederick, Baltimore	Nov. 21	Granite sills			2,300.00	Do.
J. G. & J. M. Waters, Georgetown, D. C	Nov. 22	Hydraulic cement ......barrels	2,000	$1.12 per barrel	2,240.00	Do.
Albert Flagler, New York	Nov. 23	Bricks	565,000	$7.40 per thousand	4,181.00	Do.
John G. Mars, New York	Nov. 29	Tea ......pounds	3,000	24 cents per pound	720.00	New York.
Thurber, Whyland & Co., New York	Nov. 30	Split peas ......gallons	3,000	19$\frac{8}{10}$ cents per gallon	594.00	Do.
Pickering Dodge, Washington	Nov. 30	Lime ......barrels, of 200 pounds each	565	73 cents per barrel	412.45	Washington.
George L. Neville, Portsmouth, Va	Nov. 30	Yellow pine lumber			5,571.87	Do.
Peter H. McNulty, Brooklyn	Nov. 30	Shaving boxes	2,000	57 cents each	1,140.00	New York.
San Francisco Pioneer Woolen Factory, San Francisco.	Nov. 30	6 4 11-ounce flannel ......yards	100,000	89$\frac{8}{10}$ cents per yard	89,800.00	Do.

Albert Flagler, New York	Dec. 2	Roofing felt, pounds	5,000	1¼ cents per pound	62.50	Washington.
Do	Dec. 2	Shaving soap, cakes	5,000	3 [illegible] cents each	197.50	New York.
Edward B. Hosier, New York	Dec. 2	Evaporated apples, pounds	30,000	10 [illegible] cents per pound	3,285.00	Do.
Do	Dec. 2	Rice, do	25,000	5 [illegible] cents per pound	1,457.50	Do.
Rowland A. Robbins, New York	Dec. 3	Yeoman stores			2,411.15	Do.
Do	Dec. 3	Tan colored duck, yards	5,000	22 [illegible] cents per yard		
Charles F. Fanning, Washington	Dec. 3	P. B. slates, squares	254	$6.35 per square	1,606.55	Washington.
Rowland A. Robbins, New York	Dec. 5	Tin, boxes	10	$8.45 per box	9,993.50	Do.
Do	Dec. 5	Nails, pounds	500	5 cents per pound		Do.
Do	Dec. 5	Putty, do	600	2 cents per pound		Do.
Do	Dec. 5	Solder, do	100	18 cents per pound		Do.
Do	Dec.	Glazing, square feet	4,092	50 cents per square foot		Do.
Do	Dec. 5	Roofing tin, boxes	40	4.90 cents per box		Do.
Do	Dec. 5	Hammock canvas, yards	10,000	53 [illegible] cents per yard		Boston.
Do	Dec. 5	Bag canvas, do	5,000	44 [illegible] cents per yard		Do.
J. W. Gaskill & Sons, Philadelphia	Dec. 5	White and yellow pine lumber			4,498.14	Washington.
James R. Michael, New York	Dec. 5	Eagle buttons, dozen	1,000	26 cents per dozen	1,178.00	New York.
Do	Dec. 5	Iron work				Washington.
F. B. Annadown, Philadelphia	Dec. 8	American glass, boxes	132		650.94	Do.
John C. Jahring, New York	Dec. 22	Canned roast beef, pounds	5,000	3 [illegible] cents per pound	779.17	Mare Island.
Do	Dec. 22	Canned corned beef, do	5,000	3 [illegible] cents per pound		Do.
David Duncan & Son	Dec. 31	Anthracite broken coal, tons	1,000	$5.85 per ton	5,850.00	Boston.
	1888					
Goldberg, Bowen & Co., San Francisco	Jan. 6	Tea, pounds	1,000	27½ cents per pound	560.00	Mare Island.
Do	Jan. 6	Canned vegetables, do	3,000	7½ cents per pound		Do.
Edward Reinecke, Jersey City	Jan. 13	Pure vinegar, gallons	5,024	13 [illegible] cents per gallon	665.17	New York.
James A. Craig, New York	Jan. 16	Family mess pork, barrels	500	$16.47 per barrel	8,235.00	Do.
Haas Bros., San Francisco	Jan. 17	Evaporated apples, pounds	2,000	13¼ cents per pound	265.00	Mare Island.
Joseph G. Stephens, Newport	Jan. 19	Hay, tons	4	$21 per ton	232.00	Newport.
Do	Jan. 19	Straw, do	2	$22 per ton		Do.
Do	Jan. 19	Oats, bushels	200	52 cents per bushel		Do.
Niles Tool Works, Hamilton, Ohio	Jan. 19	Shaping machines	5	$2,025 each	17,375.00	Washington.
Do	Jan. 19	do	5	$1,450 each		Do.
Robert M. McFee, Washington	Jan. 27	Sand, bushels	18,000	3¾ cents per bushel	675.00	Washington.
Brandywine Granite Co., Wilmington, Del.	Jan. 28	Granite			1,123.40	Do.
J. Edward Bates, Washington	Jan. 30	Firebricks	46,000	$26.46 per thousand	1,217.16	Do.
Mason, Chapin & Co., Providence, R. I.	Feb. 3	Paints			36.04	Newport.
Do	Feb. 3	Putty				Do.
Do	Feb. 3	Glass				Do.
Swinburne, Peckham & Co., Newport, R. I.	Feb. 6	Building materials			170.78	Do.
Merry, Faull & Co., San Francisco	Feb. 8	Pork, barrels	125	$19.95 per barrel	5,231.25	Mare Island.
Do	Feb. 8	do, half-barrels	250	$10.95 per half barrel		
Harry W. Blunt, Washington	Feb. 13	Cement, barrels	2,000	90 cents per barrel	1,800.00	Washington.
Wm. F. Bernstein, Philadelphia	Feb. 17	Mattresses	1,500	$4.44¾ each	6,671.25	New York.
Rowland A. Robbins, New York	Feb. 17	Unbleached cotton duck, yards	50,000	12 [illegible] cents per yard	6,045.00	Do.
George B. Clark, Washington	Feb. 20	Broken stone, barrels	6,000	39½ cents per barrel	2,370.00	Washington.
James R. Michael, New York	Feb. 23	Sugar, pounds	100,000	6 [illegible] cents per pound	6,850.00	New York.
William McKnight, Trenton, N. J.	Feb. 23	Kip shoes, pairs	2,000	$2.10 per pair	4,200.00	Do.
J. Freeman & Co., Orange, N. J.	Feb. 24	Calf shoes, do	3,000	$1.95 per pair	5,850.00	Do.
B. Y. Pippey & Co., New York	Feb. 24	Woolen socks, do	10,000	30½ cents per pair	3,050.00	Do.

Statement of contracts made by the Bureau of Provisions and Clothing for and in behalf of the Navy Department, etc.—Continued.

Name.	Date.	Article contracted for.	Quantity.	Price.	Amount.	Where delivered.
	1888.					
San Francisco Pioneer Woolen Factory, San Francisco.	Feb. 27	¾ 7-ounce flannel ....yards..	10,000	60½ cents per yard	$15,925.00	New York.
Do	Feb. 27	Cap cloth ....yards..	5,000	$1.79½ per yard		Do.
Jno. Parke Kendall, Washington	Mar. 2	Charcoal ....bushels..	2,000	$7\frac{9}{10}$ cents per bushel		Washington.
Do	Mar. 2	S wrenches ....dozen..	2	$1.50 per dozen	196.80	Do.
Do	Mar. 2	.... do ....do....	2	$2.90 per dozen		Do.
Do	Mar. 2	Gum packing ....pounds..	200	12 cents per pound		Do.
Manhattan Oil Co., New York	Mar. 2	Neats-foot oil ....gallons..	20	60 cents per gallon	12.00	Do.
American Tube Works, Boston	Mar. 5	Drawn copper tubing ....feet..	429	40 cents per pound	7,181.00	Do.
Do	Mar. 5	.... do ....do....	110	50 cents per pound		Do.
J. Edward Bates, Washington	Mar. 6	Sperm oil ....barrels..	6	65¾ cents per gallon		Do.
Do	Mar. 6	Hexagonal nuts ....pounds..	560	$5\frac{63}{100}$ cents per pound		Do.
Do	Mar. 6	....do ....do....	500	$5\frac{18}{100}$ cents per pound	289.78	Do.
Do	Mar. 6	....do ....do....	500	$5\frac{39}{100}$ cents per pound		Do.
Do	Mar. 6	Iron washers ....pounds..	200	$3\frac{18}{100}$ cents per pound		Do.
Do	Mar. 6	White chalk ....do....	500	89 cents per 100 pounds....		Do.
James R. Michael, New York	Mar. 7	Stencil paper ....roll..	1	9 cents per pound	20.00	Do.
Do	Mar. 7	Gum camphor ....pounds..	20	30 cents per pound		Do.
Richard W. Creed, New York	Mar. 7	Oil stones ....dozen..	2	$3.50 per dozen	7.00	Do.
Robert Boyd, Washington	Mar. 13	Wire rope ....feet..	265	$11\frac{9}{10}$ cents per foot	31.53	Do.
Meredith, Winship & Co., Georgetown, D.C	Mar. 22	Youghiogheny coal ....tons..	300	$3.85 per ton	1,470.00	Annapolis.
Do	Mar. 22	Cumberland coal ....do....	100	$3.15 per ton		Do.
Merry, Faull & Co., San Francisco	Mar. 27	Ham ....pounds..	2,000	$13.37½ per 100 pounds	505.00	Mare Island.
Do	Mar. 27	Bacon ....do....	2,000	$11.87½ per 100 pounds		Do.
Haas Brothers, San Francisco	Mar. 28	Cornmeal ....do....	6,000	$3\frac{85}{100}$ cents per pound		Do.
Do	Mar. 28	Oatmeal ....do....	6,000	$4\frac{35}{100}$ cents per pound		Do.
Do	Mar. 28	Hominy ....do....	5,000	4¼ cents per pound		Do.
Do	Mar. 28	Flour ....half-barrels..	150	2½ cents per pound		Do.
Do	Mar. 28	Beans ....gallons..	1,500	36½ cents per gallon		Do.
Do	Mar. 28	Peas (split) ....do....	800	27½ cents per gallon	5,791.50	Do.
Do	Mar. 28	Butter ....pounds..	5,000	27¾ cents per pound		Do.
Do	Mar. 28	Canned tomatoes ....do....	6,000	4 cents per pound		Do.
Do	Mar. 28	Canned salmon ....do....	6,000	13¾ cents per pound		Do.
Do	Mar. 28	Cocoa ....do....	2,000	25 cents per pound		Do.
Do	Mar. 28	Molasses ....gallons..	1,000	35 cents per gallon		Do.
Do	Mar. 28	Canned vegetables ....pounds..	9,000	6¾ cents per pound		Do.
James A. Eddy, Newport	Mar. 29	Piling and fender	....	....	1,540.00	Newport, R. I.
M. Ehrman & Co., San Francisco	Apr. 3	Rice, No. 1 ....pounds..	6,000	$5\frac{3}{10}$ cents per pound	318.00	Mare Island.
David S. Wells, New York	Apr. 7	Anthracite broken coal ....tons..	1,000	$4.04 per ton	4,040.00	New York.
Michael A. McCormick, Newport, R. I.	Apr. 12	Building improvements, Hospital No. 6	....	....	2,900.00	Newport, R. I.
T. H. Dowling & Co., San Francisco, Cal.	Apr. 12	Canned sausages ....pounds..	6,000	13 cents per pound		Mare Island.
Do	Apr. 12	Codfish ....pounds..	2,000	8¾ cents per pound	1,390.00	Do.
Do	Apr. 12	Pickles ....pounds..	6,000	5 cents per pound		Do.
Do	Apr. 12	Vinegar ....gallons..	1,000	13½ cents per gallon		Do.

Davidson Steam-pump Co., Brooklyn	Apr. 26	3 air-pumps and condensers			1,375.00	Washington.
Armington & Sims Engine Co., Providence, R. I.	May 7	Condensing and expansion engines			9,523.35	Do.
P. H. Mayo & Bro., Richmond, Va	May 9	Tobacco ... pounds	150,000	38 cents per pound	57,000.00	New York.
The Babcock & Wilcox Co., New York	May 9	5 boilers			23,896.00	Washington.
David Duncan & Son, New York	May 11	Anthracite broken coal ... tons	1,000	\$3.95 per ton	3,950.00	Norfolk.
Clara J. Townsend, New York	May 14	Rubber boots ... pairs	1,000	\$1.95 per pair	1,950.00	New York.
Samuel D. Puller, Norfolk, Va	May 14	Railroad ties	5,700	75 cents and \$1.20 each	4,464.00	Norfolk.
Thomas G. Hood, Philadelphia, Pa	May 14	Rubber buttons ... dozen	1,000	$29\frac{1}{2}$ cents per dozen	295.00	New York.
James W. Soper, New York	May 14	Railway tools			186.74	Norfolk.
James R. Michael, New York	May 15	Alpaca handkerchiefs	1,000	10 cents each	295.00	New York.
Do	May 15	Ivory buttons, medium ... dozen	1,200	55 cents per dozen		Do.
Do	May 15	Ivory buttons, small ... dozen	1,200	50 cents per dozen		Do.
Allan A. McCullough, Norfolk, Va	May 15	Yellow pine lumber			443.97	Norfolk.
Peter H. McNulty, Brooklyn	May 16	B. S. handkerchiefs	5,000	99 cents	12,648.30	New York.
Do	May 16	Cotton, spools ... dozen	7,200	31 cents per dozen		Do.
Do	May 16	Pocket handkerchiefs	5,000	$6\frac{1}{4}$ cents each		Do.
Do	May 16	Needles ... papers	2,500	$2\frac{1}{2}$ cents		Do.
Do	May 16	Red and blue worsted tape	10,000	$3\frac{1}{4}$ cents		Do.
Do	May 16	Toilet soap ... pounds	1,000	$9\frac{78}{100}$ cents per pound		Do.
Do	May 16	Salt-water soap ... do	225,000	$2\frac{1}{4}$ cents per pound		Do.
Do	May 16	Enameled cloth ... yards	2,000	25 cents per yard		Do.
Rowland A. Robbins, New York	May 17	Tin pans	4,000	$4\frac{9}{10}$ cents each	723.00	Do.
Do	May 17	Tin pots	2,000	$9\frac{7}{10}$ cents each		Do.
Do	May 17	Mess kettles	1,000	$40\frac{9}{10}$ cents each		Do.
Do	May 17	Steel rails ... tons	156	\$34.97 per ton	5,476.32	Norfolk.
Do	May 17	Ground-lever switch-stands	5	\$4.20 each		Do.
Do	May 17	Domestic wire for rigging ... pounds	23,806	$5\frac{44}{100}$ cents per pound	1,295.04	Boston.
David Duncan & Son, New York	May 17	Anthracite broken coal ... tons	1,000	\$4.65 per ton	4,650.00	Do.
Putnam & Foley, Boston	May 18	Sheeting, flax parceling, tags, oil, etc			317.99	Do.
Thompson C. Gill & Co., Philadelphia	May 19	Angle plates ... pounds	12,000	\$2.20 per 100 pounds	2,980.00	Norfolk.
Do	May 19	Track spikes ... do	10,500	$2\frac{1}{4}$ cents per pound		Do.
Do	May 19	Track bolts ... do	3,200	$3\frac{1}{4}$ cents per pound		Do.
Rowland A. Robbins, New York	May 21	Spirits turpentine, sewing palms, rungs, etc.			595.33	Boston.
J. W. Gaskill & Sons, Philadelphia	May 21	Steel frogs and steel switches (each)	5		274.00	Norfolk.
James R. Michael, New York	May 22	Spoons	7,000	2 cents each	140.00	New York.
Albert Flagler, New York	June 1	Blacking ... boxes	5,000	$2\frac{4}{10}$ cents per box	2,584.00	Do.
Do	June 1	Tooth-brushes	500	11 cents each		Do.
Do	June 1	Jack-knives	5,000	36 cents each		Do.
Do	June 1	Linen towels	4,200	$14\frac{1}{2}$ cents each		Do.

No. 11.—BUREAU OF MEDICINE AND SURGERY.

NAVY DEPARTMENT,
BUREAU OF MEDICINE AND SURGERY,
Washington, D. C., October 25, 1888.

SIR: I have the honor to submit the statistical report of the health of the Navy for the past year, together with estimates for the fiscal year ending June 30, 1890, and the condition of the naval hospital fund.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1890, by the Bureau of Medicine and Surgery, Navy Department.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1889.
Salaries, Bureau of Medicine and Surgery.		
Chief clerk (appropriated July 11, 1888)	$1,800.00	
One clerk of class three (same act)	1,600.00	
One clerk of class two (same act)	1,400.00	
One clerk of class one (same act)	1,200.00	
One clerk (same act)	1,000.00	
One assistant messenger (same act)	720.00	
One laborer (same act)	660.00	
One janitor for naval dispensary (same act)	600.00	
One laborer for naval dispensary (same act)	480.00	
	9,460.00	$9,460.00

Estimates of appropriations required for the service of the fiscal year, etc.—Continued.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1889.
Support of the medical department.		
r surgeons' necessaries for vessels in commission, navy-yards, naval stations, Marine Corps, and Coast Survey and for the civil establishment at the several naval hospitals, navy-yards, naval laboratory, museum of hygiene, and Naval Academy (appropriated September 7, 1888)	$57,500.00	$57,500.00
Naval-hospital fund.		
r the maintenance of the naval hospitals at the various navy-yards and stations (same act)	20,000.00	20,000.00
Contingent expenses of the Bureau.		
r freight or expressage on medical stores; toll; ferriages; transportation of sick and insane patients; care, transportation, and burial of the dead; advertising; telegraphing; rent of telephones; purchase of books and; stationery binding of unbound books and pamphlets; postage and purchase of stamps for foreign service; expenses attending the medical board of examiners; rent of rooms for naval dispensary and museum of hygiene; hygienic and sanitary investigation and illustration; sanitary and hygienic instruction; purchase and repairs of wagons and harness; purchase of, and feed for, horses and cows; trees, plants, garden-tools, and seeds; furniture and incidental articles for the museum of hygiene, naval dispensary, Washington; naval laboratory, sick quarters at Naval Academy and marine barracks, and dispensaries at navy-yards; washing for medical department at museum of hygiene, naval dispensary Washington; naval laboratory, sick quarters at Naval Academy and marine barracks, dispensaries at navy-yards and naval stations, and ships and rendezvous (appropriated September , 1888	25,000.00	25,000.00
Repairs, Bureau of Medicine and Surgery.		
r necessary repairs of naval laboratory, naval hospitals, and appendages, including roads, wharves, outhouses, sidewalks, fences, gardens, farms, and cemeteries (same act)	$20,000.00	$20,000.00
r continuing the improvement of the naval hospital park at Portsmouth, Va. (same act)	5,000.00	5,000.00
Sick quarters, navy-yard, Portsmouth, N. H.		
r the construction of sick quarters at the navy-yard, Portsmouth, N. H., in full for all expenses of erecting and furnishing said sick quarters, to be immediately available (submitted)	35,000.00	
Medical director's residence, Naval Hospital, Mare Island, Cal.		
r the construction of residence for medical director in charge of Naval Hospital, Mare Island, Cal., in full for all expenses of erecting, furnishing, and making necessary improvements about the grounds (submitted)	20,000.00	

NAVAL HOSPITAL FUND.

The condition of this fund is as follows, viz:

lance on hand October 1, 1887	$213,985.66
ansferred to the credit since October 1, 1887, by the Fourth Auditor of the Treasury	78,480.96
edit by appropriation for fiscal year 1889	20,000.00
	312,465.62
pended since October 1, 1887	76,875.14
lance on hand October 1, 1888	235,591.48

NAVAL HOSPITALS, SICK-QUARTERS, AND SANITARIUM.

Portsmouth, N. H.—A small wooden building belonging to "Yards d Docks," so dilapidated by age that no amount of repairs can make habitable much longer, is occupied as sick-quarters, but in every reect is unfitted for the purposes for which it is used, and it should be andoned as soon as suitable sick-quarters, or preferably a small comdious hospital, is built, at a moderate cost.

An advantageous site is found on Seavy's Island, belonging to and adjoining the navy-yard, sufficiently distant from the latter and from the neighboring town to avoid danger of communicating any pestilential disease, and yet near enough to fulfill all the requirements of the navy-yard and marine barracks.

Estimates are herewith transmitted for the erection of a building at a cost of $35,000, for which your approval is respectfully solicited.

Widow's Island, Penobscot Bay, Maine.—This hospital specially constructed, under the supervision of Passed Assistant Surgeon Heffenger, for the quarantine and treatment of the sick with yellow fever, was completed at the end of the last fiscal year.

A safe and convenient anchorage is given to infected ships, and the locality is sufficiently isolated. Three Ducker portable field hospitals have been provided, which afford accommodation for the treatment of contagious diseases. During the year a wharf was built, with a landing float, gangway plank, and a boat shelter house. For maintaining communication with the surrounding islands a steam-launch, sail-boat, and double-end row-boat have been added to the station. Walks have been laid out and graveled, and spruce, fir, and other hard-wood trees have been planted in the graded grounds. The Bureau has contracted for supplies whenever needed. The establishment as now equipped will accommodate fifty patients, and this could be increased to any desired extent by adding more Ducker pavilions.

Chelsea, Mass.—Certain repairs have been and are being made. A new system of steam-heating is about to be introduced which will occasion important saving of coal and afford heat both for the hospital and the house of the medical officer in charge.

Brooklyn, N. Y.—General renovation and repair will be required during the year. A new system of steam heating will be required next year. The steam-heating system of the house of the medical director is defective and expensive. It is being removed, and new radiators introduced which will receive steam directly from the hospital system. Eventually it is proposed to supply the house of the director of the naval laboratory with steam from the hospital. These repairs and improvements can be effected with the funds available to the Bureau.

Philadelphia, Pa.—In good condition; only slight repairs are needed. Sufficient accommodation for protecting the supply of coal from the weather is wanting. An additional coal shed is required.

Annapolis, Md.—The sick-quarters at the Naval Academy is in excellent condition, with adequate capacity for fulfilling all requirements.

Washington, D. C.—Condition satisfactory. New floors have been laid in pantries and passages, and the iron fence surrounding the grounds has been painted.

Norfolk, Va.—Since the re-occupation of the hospital so little has been expended on the unused portion that it is dilapidated and decayed to a degree making it unsafe if this portion was needed for use. In 1872 a board of experts estimated the cost of repairs of the dilapidated portion requisite to make it serviceable to amount to more than $32,000. This item is mentioned to show the actual condition of the decayed portions and the need of repairs for its preservation. The repairs already made on the occupied portion, and those required during the year, can be effected without a special appropriation.

Hospital Park improvements, Norfolk.—An appropriation of $5,000 was expended during the year in improving the Naval Hospital Park. Numerous small elevations and depressions were brought to the same level, a few trees taken out, and much undergrowth removed by grubbing. A well-shelled serpentine roadway or drive, 18 feet in width and

more than a mile in length, was made, together with graded foot-walks, 10 feet in width, whose surfaces are to be eventually covered with asphalt or other material. Settees of iron and wood have been provided. Green street in Portsmouth has been extended to the hospital property and a culvert built between the same. This extension gives a new entrance, now the principal one, at which there has been erected an ornamental gateway with side entrances. The old board fence inclosing the park is decayed, broken down in many places, needs constant patching, and in its defectiveness is entirely unfit for its original purpose. With the appropriation made this year for continuing the improvements, it is considered advisable to erect a suitable iron fence.

Sea wall, Norfolk.—The plan and specifications for the repair of the sea-wall have been prepared, and the contract for the completion of the work will be made as soon as practicable.

Pensacola, Fla.—The sick-quarters is a light frame building, well ventilated and adapted for the climate, and rests upon part of the foundation of the old hospital destroyed by fire during the civil war. It appears to be ample for the present need of the station, and was thoroughly repaired last year.

Mare Island, Cal.—During the past two years this hospital has had extensive repairs and is now in excellent condition.

The Bureau has frequently called attention to the urgent need of separate quarters for the medical officer in charge. In their absence he is obliged to occupy rooms intended for the junior medical officers, and a ward which has never been used for the patients. These apartments are not adapted for occupancy by a family comprising female members, children, and women servants. The junior medical officers have rooms on the first floor, which properly might be diverted to other purposes. If the medical director had a residence without the hospital the suitable complement of junior officers, now impossible, could be accommodated on the second floor, and enable the rooms vacated by them on the first floor to be used for public purposes. Medical Director Gihon calls attention to the expediency of vacating the ward now occupied by him whenever other quarters are afforded, to give accommodation to a number of paralytics and infirm seamen and marines, constantly increasing, for whom provision should be made for their subsistence and care-taking, thereby avoiding the crowded condition of the Naval Asylum at Philadelphia, and the expense and difficulty of a transfer thereto. The hospital at Mare Island is second in importance to that at Brooklyn. All the principal hospitals on the Atlantic coast have separate houses for the families of the medical officers in charge, and the conditions which make this so necessary exist in a greater degree at this, the only hospital on the Pacific coast for the Pacific and Asiatic stations, and where no outside quarters can be rented.

For the purpose of removing the embarrassment, estimates are submitted for building a house for the medical director at a cost of $20,000, including all the expenses of connections with the hospital system of water supply, heating, gas lighting, sewerage, and drainage, which it is hoped will meet with your approval.

Yokohama, Japan.—Our only naval hospital on a foreign station receives the sick from the merchant as well as the naval service. It is growing in importance in the estimation of the community, and it is the earnest wish of the Bureau to continue this feeling and improvement.

The hospital is in a creditable condition. A few repairs and improvements are being made together with the refurnishing of the wards and medical officers' quarters. The equipment, which was procured in 1872, has had hard usage, and is having a renewal.

Surgeon Gravatt writes:

Through the energy of my predecessor, Surgeon McMurtrie, the grounds surrounding the hospital have been reclaimed from a bleak, overgrown, and almost uncared for waste, and made attractive by ornamental trees and flowers. The English naval hospital, in proximity, has an allowance of £500 to expend upon its grounds annually

PENSION CASES.

Number of pension cases remaining on hand June 30, 1887	369
Number received during fiscal year ending June 30, 1888	2,444
Number answered during fiscal year ending June 30, 1888	2,667
Number remaining on hand June 30, 1888	146

MUSEUM OF HYGIENE.

Medical Inspector Wells reports:

On assuming charge, February 1, 1888, I found the museum overcrowded with exhibits, the library too large for its allotted space, and the laboratory fully occupied with chemical work, all of which demonstrated the healthy growth of the institution in the short period of six years, as well as the wisdom of its founders and managers. It is therefore unnecessary to advance any argument as to the need of such a museum, it being the first and only one of its special character in this country. Apart from the support which it must have from the General Government, its existence and objects must be more generally made known to the medical profession and all who are interested in sanitary science to insure its perfect and permanent success.

During the recent congress of physicians and surgeons held in this city the museum was visited by many delegates, some of whom until then were ignorant of the existence of such an institution, while all expressed surprise and gratification at what had been accomplished in so short a time, and promised their interest and support in the future.

New efforts have recently been made to enlist the co-operation of medical men, architects, builders, plumbers, inventors, and students of hygiene throughout the country. As the publicity of the museum increases so will the collection of sanitary and hygienic appliances increase, until there will be absolutely no more space in the present building for exhibition of the same. It will therefore soon become necessary to use the lower floor, now occupied by the naval dispensary, or seek a larger building.

During the past year many additions to the exhibits have been made, including some very interesting and instructive specimens of defective plumbing, faulty traps and waste pipes, and here I would add that many prominent builders and plumbers in Washington and other cities are manifesting their interest in the museum by contributions which show the advancement made in recent years in building healthful homes. The result is that the museum is frequently visited by persons who are in search of the best sanitary measures to render their new buildings wholesome and healthful.

The library is constantly receiving accessions, including the best native and foreign works and periodicals on medicine and surgery, hygiene, and scientific subjects. This increase necessitates the re-arrangement of the books and the addition of more shelves the ensuing year. We now have about 1,000 volumes ready for binding.

VACANCIES IN THE MEDICAL CORPS.

Vacancies have existed in the grade of assistant surgeon since the close of the late war. In 1877 the number of assistant surgeons allowed by law was nearly complete, only four vacancies existing. In the following year the vacancies were six. At the present time there are eleven. In twenty years the percentage of accepted candidates is 25; of rejected candidates, 75.

The board for the examination of candidates for admission into the Medical Corps has been almost continuously in session for many years. Medical Director Gorgas, president of the board, in May last reported as follows:

I have been greatly disappointed at the results of our work this year; seven of the twelve applicants were rejected physically, and but one of the others has passed professionally.

To lower the standard of examination is not considered advisable, since its character is that which should obtain for the procurement of those worthily qualified to fill the vacancies, and in justice to those who have passed the same and are now members of the Medical Corps. The

few admissions are barely adequate to fill the vacancies made by death, retirement, and resignation. A bill for the improvement of the condition of assistant surgeons in rank and pay, in conformity with your recommendation, has been presented to Congress with no near prospect of a successful issue.

INSANE OF THE NAVY.

There were seventy-nine patients belonging to the Navy treated in the Government Hospital for the Insane in the District of Columbia for the year ending September 30, 1888.

Remaining in hospital September 30, 1887		58
Admitted during the year ending September 30, 1888		21
Total under treatment		79
Discharged during the year:		
Recovered	7	
Improved	1	
Died	7	
		15
Remaining in hospital September 30, 1888:		
Officers	7	
Enlisted men	57	
		64

No severe epidemic has operated against the health of the Navy during the past year.

In September Supervising Surgeon-General Hamilton, of the U. S. Marine Hospital Service, asked for expert medical officers to make certain investigations regarding yellow fever at Fernandina, Fla., and elsewhere, and to take charge of the Government relief measures.

Surgeon Ross and Assistant Surgeon Martin, who were experienced in the management of a like epidemic, and who had already volunteered their services, were directed to hold themselves in readiness to act under instructions of Supervising Surgeon-General Hamilton.

They were assigned to duty in Florida, where they now remain.

Very respectfully, your obedient servant,

JNO. MILLS BROWNE,
Surgeon-General, U. S. Navy.

Hon. WILLIAM C. WHITNEY,
Secretary of the Navy.

Force afloat—General aggregate, 1887.

Classification of diseases.	Remaining from last year.	Admitted.	Discharged to duty.	Invalided. To hospital.	Invalided. From service.	Died.	Remaining at the end of the year.	Total number of sick days.
Morbid states and processes, irrespective of parts affected	2	73	47	24	2	......	2	578
General diseases dependent upon morbid poisons:								
Class 1	3	473	391	73	1	3	8	3,109
Class 2	12	486	462	30	......	......	6	2,197
Class 3	......	18	13	4	......	......	1	189
Class 4	9	508	446	60	2	......	9	5,769
General diseases dependent upon causes other than morbid poisons:								
Class 1	......	33	32	1	......	......	......	157
Class 2	......	127	118	8	......	1	......	360
Developmental diseases	......	3	......	3	......	......	......	7
Unclassified diseases	10	561	459	91	1	1	19	5,550
Local diseases:								
Diseases of the nervous system	8	314	259	52	4	1	6	2,333
Diseases of the eye	......	109	87	15	2	......	5	822
Diseases of the ear	......	52	48	3	1	......	......	424

Force afloat—General aggregate, 1887—Continued.

Classification of diseases.	Remaining from last year.	Admitted.	Discharged to duty.	Invalided. To hospital.	Invalided. From service.	Died.	Remaining at the end of the year.	Total number of sick days.
Local diseases—Continued.								
Diseases of the nose	......	27	24	3	......	......	......	193
Diseases of the circulatory system	1	46	23	20	2	2	......	494
Diseases of the respiratory system	5	607	492	102	......	6	12	4,453
Diseases of the digestive system	20	1,276	1,224	52	1	......	19	5,357
Diseases of the lymphatic system	9	227	194	29	......	......	13	4,338
Diseases of the urinary system	3	53	37	14	1	2	2	615
Diseases of the generative system	12	373	316	57	1	1	10	4,436
Diseases of the locomotor system	1	27	22	6	......	......	......	309
Diseases of the integumentary system	18	902	855	46	......	......	19	7,749
Parasitic diseases	......	8	8	......	......	......	......	25
Poisons	......	11	11	......	......	......	......	65
Tumors and cysts—malignant and non-malignant	......	13	10	3	......	......	......	91
Surgical operations	......	3	2	1	......	......	......	38
Injuries, etc	47	1,417	1,339	80	1	17	27	11,999
Feigned diseases	......	5	5	......	......	......	......	29
Total	160	7,752	6,924	777	19	34	158	61,685

Force afloat—Detailed statement, 1887.

Diseases.	Remaining from last quarter.	Admitted.	Discharged to duty.	Invalided. To hospital.	Invalided. From service.	Died.	Continued to next quarter.	Total number of sick days.
MORBID STATES AND PROCESSES IRRESPECTIVE OF PARTS AFFECTED.								
Adynamia	2	68	42	24	2	......	2	562
Atrophia	......	1	1	......	......	......	......	2
Hæmorrhagia	......	1	1	......	......	......	......	1
Hydrops	......	1	1	......	......	......	......	8
Œdema	......	2	2	......	......	......	......	5
GENERAL DISEASES.—DEPENDENT UPON MORBID POISONS.								
Class 1.								
Catarrhus epidemicus	......	12	12	......	......	......	......	83
Dysenteria acuta	3	34	29	4	1	2	1	276
Dysenteria chronica	......	2	1	1	......	......	......	12
Febris cerebro-spinalis	......	2	......	1	......	1	......	3
Febris continua simplex	......	229	217	11	......	......	1	1,160
Febris enterica	......	15	5	9	......	......	1	274
Febris typho-malarialis	......	8	2	1	......	......	5	95
Malaria	......	1	1	......	......	......	......	2
Morbilli	......	18	9	9	......	......	......	105
Parotitis	......	58	38	20	......	......	......	500
Roseola	......	3	1	2	......	......	......	5
Rubeola	......	1	......	1	......	......	......	1
Scarlatina	......	3	1	2	......	......	......	39
Varicella	......	78	74	4	......	......	......	542
Variola	......	9	1	8	......	......	......	42
Class 2.								
Cachexia malarialis	......	12	9	3	......	......	......	33
Febris intermittens	8	400	385	18	......	......	5	1,534
Febris remittens	4	72	66	9	......	......	1	615
Febricula	......	2	2	......	......	......	......	15
Class 3.								
Erysipelas	......	18	13	4	......	......	1	180

Force afloat—Detailed statement, 1887—Continued.

Diseases.	Remaining from last quarter.	Admitted.	Discharged to duty.	Invalided. To hospital.	Invalided. From service.	Died.	Continued to next quarter.	Total number of sick days.
GENERAL DISEASES.—DEPENDENT UPON MORBID POISONS—Continued.								
Class 4.								
Gonorrhœa	3	302	290	14	......	......	1	2,820
Syphilis consecutiva	5	124	95	30	1	......	3	1,547
Syphilis primitiva	1	82	61	16	1	......	5	1,402
GENERAL DISEASES.—DEPENDENT UPON CAUSES OTHER THAN MORBID POISONS.								
Class 1.								
Aerum effectus	......	1	1	......	......	......	......	13
Caloris effectus	......	27	26	1	......	......	......	129
Frigoris effectus	......	5	5	......	......	......	......	15
Class 2.								
Alcoholismus	......	123	114	8	......	1	......	339
Chloralismus	......	1	1	......	......	......	......	1
Delirium tremens	......	1	1	......	......	......	......	2
Ebriositas	......	1	1	......	......	......	......	1
Scorbutus	......	1	1	......	......	......	......	17
DEVELOPMENTAL DISEASES.								
Senectus	......	3	......	3	......	......	......	7
UNCLASSIFIED DISEASES.								
Anæmia	......	5	3	2	......	......	......	41
Diabetes	......	2	1	1	......	......	......	104
Goitre	......	1	......	1	......	......	......	1
Lumbago	......	14	14	......	......	......	......	94
Œdema	......	2	1	......	......	......	1	10
Podagra	1	6	5	1	......	......	1	87
Rheumatismus	3	356	285	63	1	......	10	3,560
Rheumatismus acutus	6	173	149	22	......	1	7	1,645
Torticollis	......	1	1	......	......	......	......	3
Scrofula	......	1	......	1	......	......	......	5
LOCAL DISEASES.								
Diseases of the nervous system.								
Apoplexia	......	3	1	1	......	1	......	17
Cephalalgia	1	53	52	1	......	......	1	131
Convulsio	......	15	11	4	......	......	......	134
Dementia	......	6	3	3	......	......	......	13
Epilepsia	......	21	6	12	2	......	1	210
Insolatio	......	11	11	......	......	......	......	68
Insomnia	......	3	3	......	......	......	......	78
Irritatio spinalis	......	2	......	2	......	......	......	5
Mania	......	9	5	4	......	......	......	237
Melancholia	1	12	3	9	1	......	......	248
Nausea marina	1	8	9	......	......	......	......	23
Neuralgia	......	130	120	8	......	......	2	506
Neurasthenia	......	2	1	1	......	......	......	27
Paralysis	1	10	6	4	......	......	1	221
Pleurodynia	2	6	8	......	......	......	......	53
Sciatica	1	10	9	1	......	......	1	240
Vertigo	1	13	11	2	1	......	......	63
Diseases of the eye.								
Amaurosis	......	2	......	......	2	......	......	23
Asthenopia	......	2	2	......	......	......	......	6
Blepharitis	......	1	1	......	......	......	......	1
Cataracta	......	2	......	1	......	......	1	16
Conjunctivitis	......	66	57	6	......	......	3	510
Ectropium	......	1	......	1	......	......	......	29
Hordeolum	......	5	5	......	......	......	......	13
Hypermetropia	......	1	1	......	......	......	......	2
Iritis	......	9	7	2	......	......	......	67

Force afloat—Detailed statement, 1887—Continued.

Diseases.	Remaining from last quarter.	Admitted.	Discharged to duty.	Invalided. To hospital.	Invalided. From service.	Died.	Continued to next quarter.	Total number of sick days.
LOCAL DISEASES—Continued.								
Diseases of the eye—Continued.								
Keratitis	.....	5	2	3	.....	.....	.....	34
Myopia	.....	6	3	2	.....	.....	1	30
Ophthalmia	.....	4	4	.....	.....	.....	.....	28
Sclerotitis	.....	1	1	.....	.....	.....	.....	6
Ulcus corneæ	.....	4	4	.....	.....	.....	.....	56
Diseases of the ear.								
Otalgia	.....	5	5	.....	.....	.....	.....	16
Otitis	.....	24	22	1	1	.....	.....	194
Otorrhœa	.....	12	11	1	.....	.....	.....	107
Surditas	.....	11	10	1	.....	.....	.....	107
Diseases of the nose.								
Catarrhus nasalis	.....	24	22	2	.....	.....	.....	171
Epistaxis	.....	2	2	.....	.....	.....	.....	10
Ozæna	.....	1	.....	1	.....	.....	.....	4
Diseases of the circulatory system.								
Anasarca	.....	1	1	.....	.....	.....	.....	12
Aneurysma	.....	3	1	1	.....	1	.....	15
Angina pectoris	.....	3	3	.....	.....	.....	.....	18
Hypertrophia cordis	.....	3	.....	2	1	.....	.....	38
Morbi valvularum cordis	.....	11	4	6	1	.....	.....	104
Palpitatio	1	16	11	6	.....	.....	.....	212
Paralysis cordis	.....	1	.....	.....	.....	1	.....	1
Pericarditis	.....	1	1	.....	.....	.....	.....	3
Phlebitis	.....	1	1	.....	.....	.....	.....	17
Varix	.....	6	1	5	.....	.....	.....	74
Diseases of the respiratory system.								
Asthma	1	23	18	5	.....	.....	1	207
Bronchitis acuta	2	183	156	21	.....	2	6	1,101
Bronchitis chronica	.....	47	29	17	.....	.....	1	613
Catarrhus	.....	205	199	3	.....	.....	3	851
Hæmoptysis	.....	12	9	3	.....	.....	.....	104
Laryngitis	.....	24	22	2	.....	.....	.....	110
Phthisis pneumonica acuta	.....	7	.....	6	.....	1	.....	50
Phthisis pneumonica chronica	.....	33	9	21	.....	2	1	751
Pleuritis	.....	36	30	6	.....	.....	.....	288
Pneumonia	2	37	20	18	.....	1	.....	378
Diseases of the digestive system.								
Ascites	.....	1	.....	1	.....	.....	.....	30
Cholera morbus	.....	88	86	2	.....	.....	.....	213
Colica	2	114	114	1	.....	.....	1	433
Constipatio	.....	34	30	4	.....	.....	.....	121
Congestio hepatis	.....	2	2	.....	.....	.....	.....	12
Dyspepsia	1	53	49	3	1	.....	1	333
Diarrhœa acuta	2	391	382	9	.....	.....	2	1,361
Diarrhœa chronica	1	6	6	1	.....	.....	.....	43
Enteritis	.....	5	3	2	.....	.....	.....	18
Fissura ani	.....	1	1	.....	.....	.....	.....	5
Fistula in ano	1	1	1	1	.....	.....	.....	25
Gastralgia	.....	1	.....	1	.....	.....	.....	13
Gastritis	1	32	29	2	.....	.....	2	210
Gastrodynia	.....	8	8	.....	.....	.....	.....	66
Hæmorrhois	1	35	32	4	.....	.....	.....	189
Hepatitis acuta	.....	3	1	2	.....	.....	.....	8
Icterus	2	18	17	3	.....	.....	.....	150
Odontalgia	.....	9	9	.....	.....	.....	.....	2[illegible]
Parulis	.....	5	5	.....	.....	.....	.....	1[illegible]
Peritonitis	.....	12	11	1	.....	.....	.....	104
Pharyngitis	.....	76	73	2	.....	.....	1	315
Prolapsus ani	.....	1	1	.....	.....	.....	.....	[illegible]
Rhagades ani	.....	1	1	.....	.....	.....	.....	1[illegible]
Stomatitis	.....	1	1	.....	.....	.....	.....	[illegible]
Tonsillitis	9	376	360	13	.....	.....	12	1,65[illegible]
Typhlitis	.....	2	2	.....	.....	.....	.....	1[illegible]

Force afloat—Detailed statement, 1887—Continued.

Diseases.	Remaining from last quarter.	Admitted.	Discharged to duty.	Invalided. To hospital.	Invalided. From service.	Died.	Continued to next quarter.	Total number of sick days.
LOCAL DISEASES—Continued.								
Diseases of the lymphatic system.								
Adenitis	9	222	189	29			13	4,270
Lymphangitis		5	5					66
Diseases of the urinary system.								
Albuminuria	1	9	4	4		1	1	229
Calculus		1	1					6
Cystitis	2	21	16	6			1	276
Dysuria		4	4					15
Enuresis		9	5	3	1			39
Hæmaturia		6	5	1				39
Nephritis		3	2			1		11
Diseases of the generative system.								
Balanitis		6	4	2				27
Chancroides	9	131	116	21			3	1,789
Congestio renalis		1	1					4
Epididymetis	1	25	23	2			1	374
Hydrocele		3	3					14
Hydrops articulorum		1		1				1
Orchitis	2	150	126	21			5	1,686
Paraphymosis		2	1	1				22
Phymosis		6	5				1	92
Prostatitis		3	1	2				78
Retentio urinæ		1	1					1
Spermatorrhœa		2	2					27
Talipes equina valgus		2	1		1			10
Urethræ strictura		34	27	6		1		268
Urethritis		3	2	1				21
Varicocele		3	3					22
Diseases of the locomotor system.								
Ankylosis		3	3					29
Arthritis	1	1	1	1				14
Necrosis		3	2	1				90
Periostitis		5	4	1				54
Synovitis		15	12	3				122
Diseases of the integumentary system.								
Abscessus	4	235	217	14			8	2,151
Anthrax		14	11	2			1	143
Clavus		1		1				9
Ecthyma		5	3	1			1	75
Eczema	1	40	33	5			3	567
Erythema		11	10				1	63
Furunculus	3	422	420	3			2	2,746
Herpes		12	11	1				80
Impetigo		6	6					39
Lichen		1	1					5
Onychia		8	7	1				95
Paronychia	2	31	31	1			1	294
Pemphigus		1	1					22
Porrigo		2	2					34
Psoriasis		1		1				8
Rupia		3	3					18
Scabies	2	11	10	3				115
Tinea		1	1					3
Ulcus	4	85	76	11			2	1,196
Unguis involutus	2	3	5					20
Urticaria		6	5	1				39
Verruca		3	2	1				27
PARASITIC DISEASES.								
Vermes		8	8					35

Force afloat—Detailed statement, 1887—Continued.

Diseases.	Remaining from last quarter.	Admitted.	Discharged to duty.	Invalided. To hospital.	Invalided. From service.	Died.	Continued to next quarter.	Total number of sick days.
POISONS.								
Colica pictonum	......	2	2	......	......	......	......	6
Delirium tremens	......	1	1	......	......	......	......	2
Ptyalismus	......	1	1	......	......	......	......	25
Vulnus venenatum	......	7	7	......	......	......	......	33
TUMORS AND CYSTS—(MALIGNANT OR NON-MALIGNANT).								
Adenoma	......	1	1	......	......	......	......	2
Bursitis	......	2	2	......	......	......	......	21
Cystis	......	3	3	......	......	......	......	20
Epithelioma	......	4	3	1	......	......	......	23
Fibroma	......	2	1	1	......	......	......	14
Neuroma	......	1	......	1	......	......	......	6
SURGICAL OPERATIONS.								
Amputatio	......	1	......	1	......	......	......	15
Circumcision	......	1	1	......	......	......	......	17
Tonsillotomy	......	1	1	......	......	......	......	6
INJURIES, ETC.								
Abrasio	1	62	62	......	......	......	1	371
Ambustio	3	83	78	6	......	......	2	848
Concussio	......	15	10	4	......	......	1	112
Contusio	7	343	339	6	......	......	5	2,063
Fractura	8	58	38	24	......	3	1	1,382
Hernia	2	38	23	13	1	......	3	508
Luxatio	1	19	15	4	......	......	1	252
Stremma	5	317	305	12	......	......	5	2,267
Submersio	......	11	1	......	......	10	......	11
Suicidium	......	1	......	......	......	1	......	1
Vulnus contusum	7	166	171	1	......	......	1	1,299
Vulnus incisum	3	137	137	1	......	......	2	1,079
Vulnus laceratum	5	110	104	4	......	2	5	1,400
Vulnus punctum	5	47	50	2	......	......	......	362
Vulnus sclopetarium	......	10	6	3	......	1	......	133
FEIGNED DISEASES.								
Malingering	......	1	1	......	......	......	......	14
Rheumatism	......	2	2	......	......	......	......	9
Stremma	......	2	2	......	......	......	......	6
Total	160	7,752	6,924	777	19	34	158	61,685

Navy-yards and stations—General aggregate, 1887.

Classification of diseases.	Remaining from last year.	Admitted.	Discharged to duty.	Invalided.		Died.	Remaining at the end of the year.	Total number of sick-days.
				To hospital.	From service.			
Morbid states and processes irrespective of parts affected		23	15	5			3	316
General diseases dependent upon morbid poisons:								
Class 1		74	58	13			3	449
Class 2		200	166	32			2	1,082
Class 3		7	3	4				77
Class 4	1	96	58	36			3	1,063
General diseases dependent upon causes other than morbid poisons:								
Class 1		6	6					61
Class 2		64	49	15				213
Unclassified diseases		135	111	21			3	1,063
Local diseases:								
Diseases of the nervous system		135	120	10		2	3	791
Diseases of the eye		35	25	9			1	320
Diseases of the ear		11	8	2			1	68
Diseases of the nose		10	8	1		1		70
Diseases of the circulatory system		24	17	6		1		229
Diseases of the respiratory system	7	247	205	43		2	4	1,021
Diseases of the digestive system	5	538	488	50	1		4	2,778
Diseases of the lymphatic system		18	12	6				311
Diseases of the urinary system	1	30	20	7	1	3		698
Diseases of the generative system	2	40	29	10			3	446
Diseases of the locomotor system		15	10	5				170
Diseases of the integumentary system	2	117	107	9	1		2	940
Parasitic diseases		1	1					3
Poisons		1	1					7
Injuries, etc	1	265	238	21	1	2	4	2,222
Total	19	2,092	1,755	305	4	11	36	14,998

Navy-yards and stations—Detailed statement, 1887.

Diseases.	Remaining from last quarter.	Admitted.	Discharged to duty.	Invalided.		Died.	Continued to next quarter.	Total number of sick-days.
				To hospital.	From service.			
MORBID STATES AND PROCESSES IRRESPECTIVE OF PARTS AFFECTED.								
Adynamia		20	15	4			1	224
Hæmorrhagia		1		1				1
Hydrops		2					2	91
GENERAL DISEASES, DEPENDENT UPON MORBID POISONS.								
Class 1.								
Catarrhus epidemicus		2	2					10
Diphtheria		1	1					30
Dysenteria acuta		5	4	1				13
Dysenteria chronica		3		2			1	3
Febris continua simplex		9	8				1	49
Febris enterica		2	1	1				41
Febris flava		1	1					3
Febris typho-malarialis		1					1	6
Morbilli		8	1	7				17
Roseola		6	6					42
Vaccina		31	29	2				143
Varicella		5	5					92

Navy-yards and stations—Detailed statement, 1887—Continued.

Diseases.	Remaining from last quarter.	Admitted.	Discharged to duty.	Invalided. To hospital.	Invalided. From service.	Died.	Continued to next quarter.	Total number of sick days.
GENERAL DISEASES, DEPENDENT UPON MORBID POISONS—Cont'd.								
Class 2.								
Cachexia malarialis	......	16	9	6	......	......	1	161
Febris intermittens	......	161	136	24	......	......	1	[illegible]
Febris remittens	......	23	21	2	......	......	......	314
Class 3.								
Erysipelas	......	7	3	4	......	......	......	77
Class 4.								
Gonorrhœa	1	58	38	20	......	......	1	486
Syphilis primitiva	......	15	5	10	......	......	......	[illegible]
Syphilis consecutiva	......	23	15	6	......	......	2	474
GENERAL DISEASES, DEPENDENT UPON CAUSES OTHER THAN MORBID POISONS.								
Class 1.								
Aërum effectus	......	4	4	......	......	......	......	54
Caloris effectus	......	2	2	......	......	......	......	7
Class 2.								
Alcoholismus	......	64	49	15	......	......	......	213
UNCLASSIFIED DISEASES.								
Anæmia	......	2	2	......	......	......	......	7
Febris urethritis	......	1	......	1	......	......	......	1
Diabetes	......	4	3	......	......	......	1	177
Podagra	......	8	7	1	......	......	......	77
Rheumatismus	......	90	77	11	......	......	2	614
Rheumatismus acutus	......	30	22	8	......	......	......	187
LOCAL DISEASES.								
Diseases of the nervous system.								
Apoplexia	......	2	......	......	......	1	1	4
Cephalalgia	......	53	53	......	......	......	......	113
Convulsio	......	1	1	......	......	......	......	2
Dementia	......	2	1	1	......	......	......	9
Epilepsia	......	3	1	2	......	......	......	16
Hyperæmia cerebri	......	1	......	1	......	......	......	10
Insolatio	......	1	1	......	......	......	......	3
Insomnia	......	5	4	......	......	......	1	130
Irritatio spinalis	......	2	2	......	......	......	......	15
Myelitis	......	1	1	......	......	......	......	56
Neuralgia	......	59	53	5	......	......	1	336
Paralysis	......	4	2	1	......	1	......	87
Vertigo	......	1	1	......	......	......	......	5
Diseases of the eye.								
Amaurosis	......	1	1	......	......	......	......	19
Conjunctivitis	......	16	13	3	......	......	......	72
Hordeolum	......	3	3	......	......	......	......	14
Iritis	......	6	4	1	......	......	1	120
Keratitis	......	1	1	......	......	......	......	1
Myopia	......	3	2	1	......	......	......	81
Ophthalmia	......	3	1	2	......	......	......	11
Pterygium	......	1	......	1	......	......	......	1
Ulcus corneæ	......	1	......	1	......	......	......	1
Diseases of the ear.								
Otalgia	......	3	2	1	......	......	......	11
Otitis	......	4	3	......	......	......	1	46
Ottorrhœa	......	3	2	1	......	......	......	10
Surditas	......	1	1	......	......	......	......	1

Navy-yards and stations—Detailed statement, 1887—Continued.

Diseases.	Remaining from last quarter.	Admitted.	Discharged to duty.	Invalided. To hospital.	Invalided. From service.	Died.	Continued to next quarter.	Total number of sick days.
LOCAL DISEASES—Continued.								
Diseases of the nose.								
Catarrhus nasalis		7	7					67
Epistaxis		3	1	1		1		3
Diseases of the circulatory system.								
Hypertrophia cordis		2	2					34
Morbi valvularum cordis		5		4		1		103
Palpitatio		9	8	1				66
Pericarditis		1		1				7
Phlebitis		1	1					7
Syncope		6	6					12
Diseases of the respiratory system.								
Asthma		4	4					35
Bronchitis acuta	1	69	58	9		1	2	468
Bronchitis chronica		6	4	2				85
Catarrhus	2	127	116	12			1	474
Hæmoptysis		6	3	3				59
Laryngitis	1	10	7	4				36
Phthisis pneumonica acuta		1		1				66
Phthisis pneumonica chronica	2	12	6	6		1	1	353
Pleuritis	1	9	4	6				72
Pneumonia		2	2					32
Congestio pulmonary		1	1					1
Diseases of the digestive system.								
Odontalgia		13	13					35
Cholera morbus		30	29	1				95
Colica		30	27	3				87
Constipatio		20	18	2				54
Congestio hepatis		7	7					102
Dyspepsia	2	33	29	4	1		1	257
Diarrhea acuta		193	174	17			2	636
Diarrhea chronica	2	5	6	1				107
Fistula in ano		2	2					20
Gastritis		4	3	1				164
Gastrodynia		2	1	1				14
Hæmorrhoids		12	10	2				101
Hepatitis acuta		1	1					21
Hepatitis chronica		1	1					36
Icterus		2	2					36
Pharyngitis		41	37	4				316
Rhagades ani	1		1					8
Stomatitis		2	2					11
Tonsillitis		138	123	14			1	666
Typhlitis		2	2					12
Diseases of the lymphatic system.								
Adenitis		18	12	6				311
Diseases of the urinary system.								
Albuminuria		5	2		1	2		351
Calculus		1	1					1
Cystitis	1	14	10	5				216
Enuresis		3	3					72
Ischuria		2	1	1				14
Nephritis		5	3	1		1		44
Diseases of the generative system.								
Balanitis		1	1					2
Chancroides	1	16	13	2			2	254
Epididymitis		1	1					9
Hydrocele		1	1					3
Orchitis	1	6	4	3				83
Oedema		1		1				1
Phymosis		1	1					25

Navy-yards and stations—Detailed statement, **1887—Continued.**

Diseases.	Remaining from last quarter.	Admitted.	Discharged to duty.	Invalided.		Died.	Continued to next quarter.	Total number of sick days.
				To hospital.	From service.			
LOCAL DISEASES—Continued.								
Diseases of the generative system—Cont'd.								
Prostatitis		1	1					10
Spermatorrhœa		2	2					22
Urethræ strictura		6	1	4			1	22
Varicocele		4	4					15
Diseases of the locomotor system.								
Ankylosis		1	1					5
Caries		1		1				8
Periostitis		2		2				12
Synovitis		11	9	2				145
Diseases of the integumentary system.								
Abscessus		31	27	4				224
Acne		1	1					1
Anthrax	1	4	4	1				41
Clavus		3	3					9
Ecthyma		2	2					39
Eczema		4	4					38
Erythema		1	1					3
Furunculus		38	38					248
Herpes		2	2					16
Callosities		2	1				1	26
Lichen		1	1					6
Onychia		1	1					3
Paronychia		4	3	1				26
Psoriasis		1	1					8
Tinea		3	3					25
Ulcus	1	15	11	3	1		1	201
Unguis involutus		2	2					15
Urticaria		2	2					9
PARASITIC DISEASES.								
Vermes		1	1					3
POISONS.								
Colica pictonum		1	1					7
INJURIES, ETC.								
Abrasio		15	14	1				132
Ambustio		19	15	4				141
Concussio		3	2		1			112
Contusio		54	50	4				297
Fractura		9	4	3		1	1	126
Hernia		2	1	1				18
Luxatio		3	2	1				37
Stremma		80	75	5				605
Bunion		1	1					4
Vulnus contusum		23	21	1			1	221
Vulnus incisum		27	24	1			2	196
Vulnus laceratum	1	18	19					186
Vulnus punctum		7	7					28
Vulnus sclopetarium		2	1			1		6
Injury to great toe		1	1					8
Injury to right heel		1	1					12
Total	19	2,092	1,735	305	4	11	36	14,998

Naval hospitals—General aggregate, 1887.

Classification of diseases.	Remaining from last year.	Admitted.	Discharged to duty.	Invalided. To hospital.	Invalided. From service.	Died.	Remaining at the end of the year.	Total number of sick-days.
Morbid states and processes irrespective of parts affected	8	32	21	1	7	2	9	1,979
General diseases dependent upon morbid poisons:								
Class 1	4	75	73	......	......	......	6	2,096
Class 2	6	62	59	......	5	......	4	2,124
Class 3	2	10	10	......	......	......	2	418
Class 4	16	105	92	......	9	......	20	6,364
General diseases dependent upon causes other than morbid poisons:								
Class 1	......	1	1	......	......	......	......	19
Class 2	4	61	58	1	1	1	4	1,561
Developmental diseases	4	11	8	......	2	1	4	2,162
Unclassified diseases	12	121	90	10	13	1	19	6,620
Local diseases:								
Diseases of the nervous system	26	87	52	18	18	6	19	7,883
Diseases of the eye	3	26	23	......	2	......	4	1,712
Diseases of the ear	1	4	4	......	......	......	1	85
Diseases of the nose	1	2	3	......	......	......	......	106
Diseases of the circulatory system	8	41	17	2	17	7	6	2,434
Diseases of the respiratory system	23	180	101	14	20	22	46	10,733
Diseases of the digestive system	20	118	107	3	5	5	18	4,238
Diseases of the lymphatic system	8	37	35	1	1	......	8	2,666
Diseases of the urinary system	2	24	17	......	2	2	5	1,060
Diseases of the generative system	8	76	69	......	1	......	14	3,390
Diseases of the locomotor system	2	13	9	......	4	......	2	901
Diseases of the integumentary system	10	62	49	1	5	1	16	4,173
Parasitic diseases	......	2	1	......	......	......	1	32
Tumors and cysts—malignant or non-malignant	......	5	2	2	......	1	......	271
Surgical operations	......	1	......	......	1	......	......	90
Injuries, etc	10	116	80	4	11	5	17	5,796
Total	178	1,272	990	57	124	54	225	69,513

Naval hospitals—Detailed statement, 1887.

Diseases.	Remaining from last quarter.	Admitted.	Discharged to duty.	Invalided. To hospital.	Invalided. From service.	Died.	Continued to next quarter.	Total number of sick-days.
MORBID STATES AND PROCESSES IRRESPECTIVE OF PARTS AFFECTED.								
Adynamia	7	29	19	1	6	1	9	1,850
Hæmorrhagia	......	1	1	......	......	......	......	19
Hydrops	......	1	1	......	......	......	......	29
Tuberculosis	1	1	......	......	1	1	......	81
GENERAL DISEASES—DEPENDENT UPON MORBID POISONS.								
Class 1.								
Dysenteria acuta	1	5	6	......	......	......	......	211
Dysenteria chronica	......	1	1	......	......	......	......	34
Febris cerebro spinalis	......	1	1	......	......	......	......	19
Febris continua simplex	......	8	7	......	......	......	1	236
Febris enterica	2	7	8	......	......	......	1	345
Febris recidiva	......	1	......	......	......	......	1	77
Febris typhus	......	2	2	......	......	......	......	70
Febris typho-malarialis	......	1	1	......	......	......	......	42
Morbilli	1	26	25	......	......	......	2	454
Parotitis	......	14	14	......	......	......	......	384
Roseola	......	2	2	......	......	......	......	16

Naval hospitals—Detailed statement, **1887—Continued.**

Diseases.	Remaining from last quarter.	Admitted.	Discharged to duty.	Invalided. To hospital.	Invalided. From service.	Died.	Continued to next quarter.	Total number of sick-days.
GENERAL DISEASES—DEPENDENT UPON MORBID POISONS—Cont'd.								
Class 1—Continued.								
Scarlatina		1	1					60
Vaccina		4	3				1	79
Variola		2	2					60
Class 2.								
Cachexia malarialis		10	8		1		1	320
Febris intermittens	3	39	37		3		2	1,046
Febris remittens	3	13	14		1		1	756
Class 3.								
Erysipelas	1	10	9				2	380
Phagedæna	1		1					35
Class 4.								
Gonorrhœa	3	36	31				8	1,335
Syphilis primitiva	2	22	20				4	1,121
Syphilis consecutiva	11	47	41		9		8	3,906
GENERAL DISEASES DEPENDENT UPON CAUSES OTHER THAN MORBID POISONS.								
Class 1.								
Caloris effectus		1	1					19
Class 2.								
Alcoholismus	4	60	57	1	1	1	4	1,584
Scorbutus		1	1					27
DEVELOPMENTAL DISEASES.								
Senectus	4	11	8		2	1	4	2,102
UNCLASSIFIED DISEASES.								
Anæmia		2	1				1	74
Diabetes		2		1			1	46
Goitre		1	1					34
Podagra		6	5				1	56
Rheumatismus	7	83	55	9	12	1	13	4,680
Rheumatismus acutus	5	26	28		1		2	1,651
Scrofula		1					1	71
LOCAL DISEASES.								
Diseases of the nervous system.								
Apoplexia	1	2	1			1	1	288
Cephalalgia	1	1	2					31
Cerebritis	1		1					21
Convulsio	1	4	4				1	118
Congestio spinalis	1		1					306
Dementia	2	7	2	4	1	1	1	677
Encephalitis		1	1					17
Epilepsia	1	18	7	4	5	1	2	632
Imbecillitas		1			1			10
Irritatio spinalis		2	1		1			141
Mania		6	1	3	2			171
Melancholia	1	9	2	4	3		1	489
Morphia mania		1	1					40
Neuralgia	3	18	17	1	2		1	548
Neurasthenia		2	1				1	172
Paralysis	12	10	5	2	2	3	10	3,835
Pachy meningitis	1						1	365
Pleurodynia		1	1					7
Sciatica	1	1	1		1			48
Vertigo		3	3					34

Naval hospitals—Detailed statement, 1887—Continued.

Diseases.	Remaining from last quarter.	Admitted.	Discharged to duty.	Invalided. To hospital.	Invalided. From service.	Died.	Continued to next quarter.	Total number of sick-days.
LOCAL DISEASES—Continued.								
Diseases of the eye.								
Asthenopia	1		1					78
Choroiditis		1			1			70
Cataracta		1					1	349
Conjunctivitis	1	8	8		1			489
Ectropium		1					1	89
Iritis	1	5	5				1	311
Keratitis		3	2				1	96
Myopia		3	3					169
Ophthalmia		1	1					5
Pterygium		1	1					27
Ulcus corneæ		2	2					29
Diseases of the ear.								
Otalgia		2	2					17
Otitis	1		1					5
Otorrhœa		1	1					18
Surditas		1					1	45
Diseases of the nose.								
Catarrhus nasalis	1		1					8
Epistaxis		1	1					17
Ozæna		1	1					81
Diseases of the circulatory system.								
Aneurysma	2	7	4	2	1	2		351
Angina pectoris		1	1					6
Hypertrophia cordis		5	1		3	1		164
Morbi valvularum cordis	4	16	5		8	4	3	1,864
Palpitatio	2	7	5		3		1	276
Pericarditis		1			1			29
Syncope		1	1					7
Varix		3			1		2	237
Diseases of the respiratory system.								
Asthma	3	8	4	1	2	2	2	737
Bronchitis acuta	5	25	20		3		7	1,357
Bronchitis chronica		27	15	2	2		8	1,272
Catarrhus	2	19	17				4	390
Hæmoptysis		2	1				1	252
Laryngitis		8	6			1	1	277
Phthisis pneumonica acuta	1	9	2	3	1	1	3	716
Phthisis pneumonica chronica	11	49	12	7	12	13	16	4,612
Pleuritis		13	10				3	535
Pneumonia	1	20	14	1		5	1	585
Diseases of the digestive system.								
Ascites		1				1		19
Cholera morbus		3	3					74
Colica	1	7	7		1			116
Constipatio		7	5	1			1	403
Congestio hepatis		1	1					28
Cirrhosis hepatis		2			1	1		24
Dyspepsia	3	11	11		1		2	834
Diarrhœa acuta		26	22	1			3	526
Diarrhœa chronica	2	3	3			2		263
Enteritis		3	3					85
Fistula in ano	1	1	1				1	168
Gastritis	2	4	5	1				178
Gastrodynia	1	1	2					5
Hæmatemesis		3	2				1	14
Hæmorrhois	3	3	3		2		1	209
Hepatitis acuta		2	1			1		20
Hepatitis chronica	1	1	2					94
Icterus	1	4	3				2	271
Pharyngitis	1	8	8				1	320
Prolapsus ani		1	1					16

Naval hospitals—Detailed statement, 1887—Continued.

Diseases.	Remaining from last quarter.	Admitted.	Discharged to duty.	Invalided. To hospital.	Invalided. From service.	Died.	Continued to next quarter.	Total number of sick-days.
LOCAL DISEASES—Continued.								
Diseases of the digestive system—Continued.								
Rhagades ani	......	1	1	......	......	......	......	[illegible]
Tonsillitis	2	25	21	......	......	......	6	[illegible]
Ulcus recti	2	......	2	......	......	......	......	[illegible]
Diseases of the lymphatic system.								
Adenites	8	35	34	......	1	......	8	2,644
Lymphadenosis	......	2	1	1	......	......	......	[illegible]
Diseases of the urinary system.								
Albuminuria	......	2	......	......	......	1	1	57
Congestio renalis	......	1	1	......	......	......	......	[illegible]
Cystitis	1	11	9	......	......	......	3	[illegible]
Enuresis	......	3	2	......	......	......	1	[illegible]
Foreign body in bladder	......	1	1	......	......	......	......	45
Hæmaturia	......	2	2	......	......	......	......	[illegible]
Nephritis	1	4	2	......	2	1	......	242
Diseases of the generative system.								
Balanitis	......	2	1	......	......	......	1	110
Chancroides	7	20	23	......	......	......	4	[illegible]
Epididymitis	......	2	2	......	......	......	......	[illegible]
Hydrocele	1	......	1	......	......	......	......	[illegible]
Orchitis	......	28	23	......	1	......	4	[illegible]
Paraphymosis	......	2	2	......	......	......	......	54
Phymosis	......	1	......	......	......	......	1	[illegible]
Prostatitis	......	1	1	......	......	......	......	[illegible]
Urethræ strictura	......	17	14	......	......	......	3	[illegible]
Urethritis	......	2	2	......	......	......	......	[illegible]
Varicocele	......	1	......	......	......	......	1	[illegible]
Diseases of the locomotor system.								
Ankylosis	......	1	......	......	1	......	......	[illegible]
Caries	......	2	2	......	......	......	......	[illegible]
Necrosis	......	1	1	......	......	......	......	24
Periostitis	......	4	3	......	......	......	1	[illegible]
Synovitis	2	5	3	......	3	......	1	[illegible]
Diseases of the integumentary system.								
Abscessus	4	22	19	......	1	1	5	[illegible]
Acne	......	1	......	......	......	......	1	[illegible]
Anthrax	......	5	3	......	1	......	1	[illegible]
Eczema	3	6	5	1	1	......	2	[illegible]
Erythema	1	1	2	......	......	......	......	[illegible]
Furunculus	......	3	2	......	......	......	1	[illegible]
Herpes	1	2	3	......	......	......	......	[illegible]
Lichen	......	1	......	......	......	......	1	[illegible]
Onychia	......	1	1	......	......	......	......	[illegible]
Paronychia	......	2	1	......	1	......	......	[illegible]
Psoriasis	......	1	......	......	1	......	......	[illegible]
Scabies	......	3	2	......	......	......	1	46
Ulcus	1	13	11	......	......	......	3	700
Unguis involutus	......	1	......	......	......	......	1	12
PARASITIC DISEASES.								
Vermes	......	2	1	......	......	......	1	[illegible]
TUMORS AND CYSTS (MALIGNANT OR NON-MALIGNANT).								
Carcinoma	......	1	......	......	......	1	......	53
Epithelioma	......	1	1	......	......	......	......	[illegible]
Neuroma	......	1	1	......	......	......	......	[illegible]
Carcinoma pulmonalis	......	2	......	2	......	......	......	85
SURGICAL OPERATIONS.								
Amputatio (right arm)	......	1	......	......	1	......	......	90

Naval hospitals—Detailed statement, 1878—Continued.

Diseases.	Remaining from last quarter.	Admitted.	Discharged to duty.	Invalided. To hospital.	Invalided. From service.	Died.	Continued to next quarter.	Total number of sick-days.
INJURIES, ETC.								
Ambustio		10	10					250
Concussio		7	3			1	3	167
Contusio	1	11	11				1	227
Fractura	4	32	25	1	1	4	5	2,468
Hernia	2	12	5	1	7		1	632
Luxatio		5	4		1			187
Stremma		18	16				2	875
Vulnus contusum		7	5	1			1	116
Vulnus incisum	2	1	2				1	38
Vulnus laceratum	1	6	5		1		1	288
Vulnus punctum		1	1					4
Vulnus sclopetarium		6	2	1	1		2	535
Total	178	1,272	990	57	124	54	225	69,513

Number of persons examined for the naval service during the year 1887	9,853
Number accepted	6,076
Number rejected	3,777
Color blind	165
Rejected per thousand	383+
Color blind per thousand	16+

Report of vaccination.

	Successful.	Unsuccessful.
No evidence of previous vaccination	205	282
Presenting good cicatrices	1,034	3,436
Evidence of former attack of small-pox	23	104

Ratio per thousand of admissions for each class of disease of the force afloat.

Classification of diseases.	Ratio.	Classification of diseases.	Ratio.
Morbid states and processes irrespective of parts affected	[illegible]	Local diseases—Continued:	
General diseases dependent upon morbid poisons:		Diseases of the circulatory system	5.21
Class 1	52.85	Diseases of the respiratory system	67.95
Class 2	75.29	Diseases of the digestive system	143.90
Class 3	1.90	Diseases of the lymphatic system	26.20
Class 4	5.40	Diseases of the urinary system	6.21
General diseases dependent upon causes other than morbid poisons:		Diseases of the generative system	42.74
Class 1	3.06	Diseases of the locomotor system	3.40
Class 2	14.10	Diseases of the integumentary system	102.15
Developmental diseases	.33	Parasitic diseases	.88
Unclassified diseases	6.40	Poisons	1.22
Local diseases:		Tumors and cysts:	
Diseases of the nervous system	35.75	Malignant and non-malignant	1.44
Diseases of the eye	12.10	Surgical operations	.33
Diseases of the ear	5.77	Injuries, etc	162.55
Diseases of the nose	2.59	Ill-defined diseases	.55
		Total	878.52

SUMMARY FORCE AFLOAT.

Daily average number of sick	171.73
Average number of days each case was under treatment	7.79
Admissions per thousand of mean strength	878.52
Invaliding per thousand of mean strength	88.38
Deaths per thousand of mean strength	3.77

Proposals for repairs to steam machinery at naval laboratory, New York, September 9, 1887.

Bidder.	Amount.
James Bulger	$650.00
Andrew Keenan	795.00
Thaddeus Buck	675.00

Contract awarded to James Bulger.

Proposals for surgical instruments and appliances for naval laboratory, New York, September 16, 1887.

Bidder.	Class I.	Class II.
McKesson & Robbins	$857.98	$576.28
Hazard, Hazard & Co	879.00	No bid.

Contracts awarded to McKesson & Robbins for both classes.

Proposals for granite coping for naval hospital, Mare Island, California, September 26, 1887.

Bidder.	Amount.
M. J. Healy & Co	$300.00
Thomas M. Doyle	299.50

Contract awarded to Thomas M. Doyle.

Proposals for repairs to roof, etc., to naval hospital, Norfolk, Va., September 30, 1887.

Bidder.	Amount.
W. H. Barnard	$750.00
J. V. Kiernan	590.00
James E. Wright	560.00
B. A. Richardson	470.00
John Massingham	380.00

Contract awarded to John Massingham.

Proposals for supplying oyster shells for naval hospital, Norfolk, Va., October 29, 1887.

Bidder.	Amount.
A. V. Grice	$2,250.00
William A. Winston	2,480.00
George L. Neville	2,025.00
Nottingham & Wrenn	1,342.50
Baker & Cuffee	1,900.00
A. A. McCullough	2,175.00

Contract awarded to Nottingham & Wrenn.

CONTRACTS.

Proposal for care and feed of horses (including care of vehicles) for naval dispensary, Washington, D. C., June 27, 1887.

Bidder.	Each per month.
John H. Clark	$20.00

One bid; contract awarded to John H. Clark.

Proposals for repairs of naval hospital, Pensacola, Fla., August 19, 1887.

Bidder.	Amount.
A. V. Chubbs	$1,400.00
Frank Swares	925.00
Robert Jackson	975.00
Hugh McHatton	1,052.30

Contract awarded to Frank Swares.

Proposal for repairs of roof, etc., of naval hospital, Brooklyn, N. Y., September 13, 1887.

Bidder.	Amount.
James White	$2,650.00

One bid; contract awarded to James White.

Proposals for repair and building addition to stable at naval laboratory, Brooklyn, N. Y. September 9, 1887.

Bidder.	Amount.
James Dillon	$3,274.00
Thomas Hayden	3,300.00
Patrick Murphy	2,625.00
Charles Collins	3,491.00
P. J. Carlin	3,150.00
Long & Barnes	2,971.00
Alex. McKnight	2,635.75
John H. O'Rourke	4,100.00

Contract awarded to Patrick Murphy.

Proposals for repairs to steam machinery at naval laboratory, New York, September 9, 1887

Bidder.	Amount.
James Bulger	$650.00
Andrew Keenan	795.00
Thaddeus Buck	675.00

Contract awarded to James Bulger.

Proposals for surgical instruments and appliances for naval laboratory, New York, September 16, 1887.

Bidder.	Class I.	Class II.
McKesson & Robbins	$857.98	$576.38
Hazard, Hazard & Co	879.00	No bid.

Contracts awarded to McKesson & Robbins for both classes.

Proposals for granite coping for naval hospital, Mare Island, California, September 26, 1887.

Bidder.	Amount.
M. J. Healy & Co	$300.00
Thomas M. Doyle	290.00

Contract awarded to Thomas M. Doyle.

Proposals for repairs to roof, etc., to naval hospital, Norfolk, Va., September 30, 1887.

Bidder.	Amount.
W. H. Barnard	$750.00
J. V. Kiernan	590.00
James E. Wright	560.00
B. A. Richardson	470.00
John Massingham	380.00

Contract awarded to John Massingham.

Proposals for supplying oyster shells for naval hospital, Norfolk, Va., October 29, 1887.

Bidder.	Amount.
A. V. Grice	$2,250.00
William A. Winston	2,480.00
George L. Neville	2,025.00
Nottingham & Wrenn	1,342.50
Baker & Cuthee	1,900.00
A. A. McCullough	2,175.00

Contract awarded to Nottingham & Wrenn.

Proposals for supplying the naval hospital at Portsmouth, N. H., etc.—Continued.

Articles.	Herman R. Paul.	Norton & Gerrish.	Clarence M. Prince.
CLASS II—Continued.			
Potatoes, Irish, early rose ....per barrel..	$2.25	$2.00	....
Potatoes, sweet........do....	3.00	2.75	....
Peaches, canned, 2-pound tins........per dozen..	1.00	1.50	....
Pepper, black, ground........per pound..	.30	.25	....
Peas, canned, 2-pound tins ....per dozen..	1.00	1.40	....
Pickles, mixed........per pound..	.05	.04	....
Powder, baking, Royal ....do....	.40	.45	....
Powder, Persian insect ....do....	.25	.50	....
Prunes ....do....	.08	.07½	....
Rice, choice........do....	.07	.07	....
Raisins, layer........do....	.18	.15	....
Salt, table ....do....	.02	.01¾	....
Salt, coarse........per bushel..	.25	.50	....
Soap, laundry, Higgins's best........per pound..	.08	.09	....
Soap, salt-water ....do ...	.05	.05	....
Soap, toilet........per box..	.25	.25	....
Soap, soft........per barrel..	.50	1.00	....
Starch, corn ....per pound..	.12	.10	....
Sapolio........per dozen..	1.00	1.20	....
Starch, laundry........per pound..	.09	.08	....
Spices, assorted........do....	.30	.40	....
Sugar, white, standard block ....do....	.10	.10	....
Sugar, granulated, standard ....do....	.10	.08½	....
Sugar, yellow, light... ....do....	.10	.07	....
Soda, washing........do....	.05	.04	....
Squash........	2.00	2.00	....
Tomatoes, fresh ....per bushel..	.50	1.00	....
Turnips........per barrel..	.50	.60	....
Tapioca ....per pound..	.06	.06½	....
Tea, Oolong, best........do....	.60	.60	....
Tomatoes, 3-pound tins........per dozen..	1.40	1.30	....
Vermicelli ....per pound..	.15	.15	....
Vinegar, best cider ....per gallon..	.25	.25	....
Vanilla essence, 4-ounce bottles........per dozen..	1.50	1.50	....
Wax-tapers, lighting ....per box..	.10	.20	....
CLASS III.			
Butter, choice, new creamery........per pound..	.30	.30	$0.28
Cheese, prime ....do....	.16	.12	.15
Eggs, fresh and large ....per dozen..	.28	.28	.24
CLASS V.			
Milk, pure........per quart..	.06	.07	....
CLASS VI.			
Bread, fresh, 1-pound loaves ....per pound..	.07	.07	....

Classes I and III awarded to Clarence M. Prince; Class II awarded to Norton & Gerrish; Classes V and VI awarded to Herman R. Paul.

Proposals for supplying the naval hospital at Portsmouth, N. H., for fiscal year 1888.

Articles.	Herman R. Paul.	Norton & Gerrish.	Clarence M. Prince.
CLASS I.			
Bacon, sides, sugar-cured .... per pound..	$0.09	$0.11	$0.12
Beef, corned, Baltimore, ex. family .... do....	.12	.11	.10
Beef, roasting (exclusive of flank, neck, shoulder, or round pieces). do....	.20	.19½	.18
Beef-steak, prime cuts .... do....	.24	.24	.22
Beef, round, clear, no shin or flank .... do....	.15	.14½	.14
Beef shins .... do....	.06	.05	.05
Chickens, full-grown, killed and dressed .... do....	.22	.22½	.20
Chickens, spring .... do....	.22	.25	.21
Fish, fresh .... do....	.07	.05	.06
Liver, fresh .... do....	.05	.05	.05
Mutton, prime, fore and hind quarters in equal number .... do....	.16	.15	.14
Mutton-chops .... do....	.16	.16	.16
Oysters, fresh and large .... per quart..	.30	.35	.30
Pork, salt .... per pound..	.12	.11	.10
Pork, fresh .... do....	.12	.15	.13
Pork sausage .... do....	.12	.14	.13
Pork-steak .... do....	.12	.14	.15
Turkey, killed and dressed .... do....	.24	.25	.22
Veal, hind quarter .... do....	.15	.13	.14
CLASS II.			
Apples .... per barrel..	2.00	1.90	....
Apples, dried .... per pound..	.07	.08	....
Beans, dried, mediums, white .... per bushel..	2.25	2.50	....
Beer, lager .... per dozen..	.63	.63	....
Brooms, corn, No. 1, patent .... do....	3.00	2.95	....
Buckets, water, oak, 3-hoop .... do....	1.00	3.50	....
Bath-brick .... do....	.25	.60	....
Brushes, stove .... do....	.50	1.00	....
Brushes, scrubbing .... do....	.50	1.00	....
Brushes, dust, long-handled .... do....	1.00	2.00	....
Barley, pearl .... per pound..	.07	.06	....
Bluing, laundry, pint bottles .... per dozen..	.75	1.00	....
Beans, string .... per bushel..	.50	.50	....
Blacking, stove .... per pound..	.25	.24	....
Beets .... per bushel..	.50	.40	....
Cranberries .... do....	2.00	2.00	....
Carrots .... per barrel..	.75	.60	....
Cabbage, large heads .... per dozen..	1.20	1.10	....
Corn, sweet ears	.25	.50	....
Chocolate, Baker's .... per pound..	.38	.38	....
Corn-meal, yellow, bolted .... do....	2.00	2.00	....
Coffee, prime Rio, whole, roasted .... do....	.35	.28	....
Corn, canned, 2-pound tins .... per dozen..	1.25	1.00	....
Clothes-pins .... per gross..	.15	.25	....
Candles, adamantine .... per pound..	.20	.17	....
Crackers, water .... do....	.08	.07¾	....
Farina .... do....	.08	.08	....
Flour, best quality .... per barrel..	7.00	7.25	....
Fish, salt .... per pound..	.06	.05	....
Greens .... per bushel..	.25	.75	....
Gelatine, 2-ounce packages .... per dozen..	1.50	1.50	....
Hominy .... per pound..	.02	.02	....
Hams, prime, sugar-cured .... do....	.16	.15	....
Lard, prime, in tubs .... do....	.12	.10	....
Lemon essence, 4-ounce bottles .... per dozen..	2.00	2.25	....
Lemons .... do....	.25	.25	....
Lye, concentrated .... do....	1.00	1.80	....
Macaroni .... per pound..	.15	.15	....
Mustard, Coleman's best .... do....	.25	.25	....
Molasses, N. O., choice .... per gallon..	.55	.50	....
Matches, safety .... per gross..	1.25	1.15	....
Mackerel, No. 1 .... per barrel..	1.00	6.00	....
Onions .... per bushel..	1.25	1.00	....
Oatmeal .... per pound..	5.00	4.90	....
Oranges .... per dozen..	.15	.25	....
Oil, sperm .... per gallon..	.30	.60	....
Oil, salad, 8-ounce bottles .... per bottle..	.15	.42	....
Oil, Pratt's astral .... per gallon..	.15	.17	....
Parsnips .... per bushel..	.25	.50	....
Peas, green .... do....	.50	.50	....

Proposals for supplying the naval hospital at Chelsea, Mass., for fiscal year 1888—Cont'd.

Articles.		Boston Ice Co.	Chas. A. Simonds.	Andrew J. Bacon & Co.	Michael J. Doran.	Horace P. Stevens.
Class II—Continued.						
Parsnips	per bushel		$0.50	$0.60	$0.75	$0.10
Peas, green	do		.50	.75	1.00	.25
Potatoes, Irish, Early Rose	per barrel		1.85	1.80	1.80	1.85
Potatoes, sweet	do		1.50	2.00	2.25	1.25
Peaches, canned, 2-pound tins	per dozen		.95	.90	1.30	1.00
Pepper, black, ground	per pound		.15	.20	.30	.10
Peas, canned, 2-pound tins	per dozen		1.10	.90	1.35	.75
Pickles, mixed	per pound		.05	.04	.05	.05
Powder, baking, Royal	do		.23	.38	.43	.05
Powder, Persian insect	do		.15	.60	.25	.30
Prunes	do		.08	.09	.06½	.05
Rice, choice	do		.06½	.04	.07	.05
Raisins, layer	do		.10	.15	.10	.10
Salt, table	do		.00½	.00½	.02	.00½
Salt, coarse	per bushel		.10	.35	.40	.10
Soap, laundry, Higgins's best	per pound		.05¼	.04	.06	.05
Soap, salt-water	do		.02	.03	.06	.00½
Soap, toilet	per box		.07	.22	.50	.10
Soap, soft	per barrel		.75	2.30	2.00	.50
Starch, corn	per pound		.09	.07	.07	.06
Sapolio	per dozen		.50	.75	.95	.75
Starch, laundry	per pound		.04	.05	.05	.04
Spices, assorted	do		.10	.25	.25	.10
Sugar, white, standard block	do		.04½	.07	.07	.05
Sugar, granulated, standard	do		.07	.06½	.06½	.07
Sugar, yellow, light	do		.04	.05	.05	.02
Soda, washing	do		.00½	.01½	.02	.01
Squash	per 100 pounds		.50	1.50	2.00	.50
Tomatoes, fresh	per bushel		.25	.50	.50	.15
Turnips	per barrel		.70	1.00	1.25	.50
Tapioca	per pound		.02	.05	.07	.02
Tea, Oolong, best	do		.35	.30	.40	.28
Tomatoes, 3-pound tins	per dozen		1.10	1.15	1.20	.90
Vermicelli	per pound		.02	.09	.07	.02
Vinegar, best cider	per gallon		.12	.13	.15	.10
Vanilla essence, 4-ounce bottles	per dozen		.20	1.35	3.00	.10
Wax tapers, lighting	per box		.10	.38	.16	.10
Class III.						
Butter, choice, new creamery	per pound		.24½	.25	.25	.23
Cheese, prime	do		.09	.09	.10	.05
Eggs, fresh and large	per dozen		.24½	.25	.25	.23
Class IV.						
Ice	per 100 pounds	$0.20	.20			.12½
Class V.						
Milk, pure	per quart		.04½	.04½	.05	.04½
Class VI.						
Bread, fresh, 1-pound loaves	per pound		.03½	.03½	.03	.03
Class VII.						
Bran	per pound		.50			.15
Corn (horse-feed)	per bushel		.60			.55
Corn-meal, unbolted, yellow	per 100 pounds		.50			.25
Feed, fine	do		.50			.10
Hay, loose, best timothy	do		1.00			.25
Hay, baled, best timothy	do		1.00			.25
Oats, No. 1, white	per bushel		.55			.50
Straw, baled	per 100 pounds		1.00			.25
Shorts	per bushel		.28			.25
Screenings	do		.25			.10

Contract for Classes I, II, III, IV, V, VI, VII awarded to Horace P. Stevens.

Proposals for supplying the naval hospital at Chelsea, Mass., for fiscal year 1888.

Articles.	Boston Ice Co.	Chas. A. Simonds.	Andrew J. Bacon & Co.	Michael J. Doran.	Horace P. Stevens.
Class I.					
Bacon, sides, sugar-cured .... per pound..	....	$0.06	$0.11	$0.12	$0.09
Beef, corned, Baltimore, extra family .... do...	....	.06	.05	.08	.05
Beef, roasting (exclusive of flank, neck, shoulder, or round pieces) .... per pound..	....	.08	.07	.08	.07
Beef-steak, prime cuts .... do...	....	.15	.18	.20	.10
Beef, round, clear, no shin or flank .... do...	....	.07	.08	.13	.07
Beef-shins .... do...	....	.02	.01½	.03	.02½
Chickens, full-grown, killed and dressed .... do...	....	.16⅔	.15	.17	.15
Chickens, spring .... do...	....	.20	.20	.32	.18
Fish, fresh .... do...	....	.04	.04½	.07	.04
Liver, fresh .... do...	....	.03	.05	.05	.03
Mutton, prime, fore and hind quarters in equal number. do ...	....	.09	.08½	.10	.08
Mutton-chops .... do...	....	.12	.08½	.13	.10
Oysters, fresh and large .... per quart..	....	.25	.32	.35	.23
Pork, salt .... per pound..	....	.06	.07½	.09	.06
Pork, fresh .... do...	....	.06	.08	.10	.06
Pork sausage .... do...	....	.06	.08	.10	.06
Pork-steak .... do...	....	.06	.08	.10	.06
Turkey, killed and dressed .... do...	....	.16⅔	.14	.17	.15
Veal, hind quarter .... do...	....	.10	.07	.13	.08
Class II.					
Axle-grease .... per box..	....	.10	.08	.10	.05
Apples .... per barrel..	....	2.00	1.25	2.00	1.50
Apples, dried .... per pound..	....	.03	.04	.04	.02
Beans, dried, medium, white .... per bushel..	....	1.60	1.85	1.65	1.50
Beer, lager .... per dozen..	....	.70	.63	.55	.65
Brooms, corn, No. 1, patent .... do...	....	2.00	2.50	2.70	1.50
Buckets, water, oak, 3-hoop .... do...	....	2.00	5.50	5.00	1.00
Bath-brick .... do...	....	.10	.25	.40	.10
Brushes, stove .... do...	....	1.25	1.50	1.50	.25
Brushes, scrubbing .... do...	....	1.25	1.00	1.50	1.00
Brushes, dust, long-handled .... do...	....	1.45	6.00	8.00	.50
Barley, pearl .... per pound..	....	.02	.04½	.05	.01
Bluing, laundry, pint bottles .... per dozen..	....	1.00	1.13	.90	1.00
Beans, string .... per bushel..	....	.20	.60	.60	.25
Blacking, stove .... per pound..	....	.15	.15	.12	.02
Beets .... per bushel..	....	.23	.60	.50	.10
Cranberries .... do...	....	.75	.75	2.00	.75
Carrots .... per barrel..	....	.50	.60	1.25	.25
Cabbage, large heads .... per dozen..	....	.50	.70	.95	.50
Corn, sweet, ears .... per 100..	....	.75	.75	1.75	.50
Chocolate, Baker's .... per pound..	....	.33	.38	.40	.30
Corn-meal, yellow, bolted .... per 100 pounds..	....	1.00	1.25	1.75	1.00
Coffee, prime Rio, whole, roasted .... per pound..	....	.25	.22½	.24	.15
Corn, canned, 2-lb tins .... per dozen..	....	1.00	1.10	1.25	.90
Clothes-pins .... per gross..	....	.08	.12	.14	.10
Candles, adamantine .... per pound..	....	.15	.12	.14	.15
Crackers, water .... do...	....	.10	.12	.11	.05
Farina .... do...	....	.10	.09	.10	.10
Flour, best quality .... per barrel..	....	5.50	5.50	5.50	4.00
Fish, salt .... per pound..	....	.03	.04	.06	.02½
Greens .... per bushel..	....	.10	.25	.40	.10
Gelatine, 2-ounce packages .... per dozen..	....	.75	1.10	1.30	.75
Hominy .... per pound..	....	.02	.02	.05	.02
Hams, prime, sugar-cured .... do...	....	.11	.12	.12	.10
Lard, prime, in tubs .... do...	....	.06½	.05	.07½	.03
Lemon essence, 4-ounce bottles .... per dozen..	....	.50	1.65	2.00	.15
Lemons .... do...	....	.18	.18	.20	.20
Lye, concentrated .... do...	....	.75	1.13	.95	.75
Macaroni .... per pound..	....	.08	.08	.11	.07
Mustard, Coleman's best .... do...	....	.18	.28	.25	.10
Molasses, N. O. choice .... per gallon..	....	.25	.45	.40	.25
Matches, safety .... per gross..	....	.55	2.10	.55	.50
Mackerel, No. 1 .... per half barrel..	....	7.00	12.30	5.00	3.50
Onions .... per bushel..	....	1.00	.90	.70	.75
Oatmeal .... per 100 pounds..	....	3.00	2.75	3.50	3.00
Oranges .... per dozen..	....	.20	.15	.30	.20
Oil, sperm .... per gallon..	....	.70	.95	.90	.50
Oil, salad, 8-ounce bottles .... per bottle..	....	.50	.21	.10	.25
Oil, Pratt's astral .... per gallon..	....	.10	.14	.10½	.06½

Beans, string	per bushel		.50	1.00				.40				.50	
Blacking, stove	per pound		.50	.05				.25				.10	
Beets	per bushel		.10	.60				.75				.10	
Cranberries	do		2.00	1.90				2.50				1.00	
Carrots	per barrel		1.00	1.50				.40				.25	
Cabbage, large heads	per dozen		.60	.70				1.00				.70	
Corn, sweet-ears	do		.15	.90				1.00				.75	
Chocolate, Baker's	per pound		.40	.41				.40				.39	
Corn-meal, yellow, bolted	do		.03	1.65				1.75				1.70	
Coffee, prime Rio, whole, roasted	do		.25	.24				.22				.22	
Corn, canned, 2-pound tins	per dozen		1.50	1.10				.95				.95	
Clothes-pins	per gross		.10	.60				.20				.18	
Candles, adamantine	per pound		.10	.13				.10				.12	
Crackers, water	do		.10	.06½				.07				.07	
Farina	do		.05	.08				.10				.10	
Flour, best quality	per barrel		5.00	5.95				5.50				5.75	
Fish, salt	per pound		.05	.04¾				.05½				.05½	
Greens	per bushel		.20	.10				.50				.05	
Gelatine, 2-ounce packages	per dozen		1.50	.60				1.13				.75	
Hominy	per pound		.02	.04				.03				.03	
Hams, prime, sugar-cured	do		.12	.13½				.13½				.14	
Lard, prime, in tubs	do		.08	.08½				.09				.09	
Lemon essence, 4-ounce bottles	per dozen		1.50	.65				1.00				1.00	
Lemons	do		.50	.20				.25				.20	
Lye, concentrated	do		1.00	1.25				1.00				1.00	
Macaroni	per pound		.10	.07				.10				.09	
Mustard, Coleman's best	do		.30	.20				.23				.23	
Molasses, New Orleans choice	per gallon		.50	.42				.45				.44	
Matches, safety	per gross		1.00	.80				.65				.68	
Mackerel, No. 1	per barrel		10.00	4.38				8.50				6.00	
Onions	per bushel		1.00	1.00				1.00				.50	
Oatmeal	per 100 pounds		3.00	3.25				3.15				3.00	
Oranges	per dozen		.50	.28				.25				.25	
Oil, sperm	per gallon		.75	1.35				1.60				1.60	
Oil, salad, 8-ounce bottles	per bottle		.40	.30				.10				.25	
Oil, Pratt's astral	per gallon		.10	.30				.12				.11	
Parsnips	per bushel		.20	1.00				.50				.10	
Peas, green	do		.75	1.00				.50				.10	
Potatoes, Irish, Early Rose	per barrel		2.00	2.40				1.75				1.90	
Potatoes, sweet	do		.50	2.75				2.50				1.50	
Peaches, canned, 2-pound tins	per dozen		2.50	1.30				1.50				1.70	
Pepper, black, ground	per pound		.20	.20				.22				.22	
Peas, canned, 2-pound tins	per dozen		1.50	1.20				1.20				1.00	
Pickles, mixed	per pound		.05	.07				.08				.08	
Powder, baking, Royal	do		.40	.25				.40				.38	
Powder, Persian insect	do		.50	.60				.75				.75	
Prunes	do		.06	.05				.05				.04	
Rice, choice	do		.06	.06½				.06				.05	
Raisins, layer	do		.10	.13				.15				.10	
Salt, table	do		.01	.00¾				.01				.01	
Salt, coarse	per bushel		.50	.50				.70				.65	
Soap, laundry, Higgins' best	per pound		.03	.06½				.04½				.05	

Proposals for supplying the naval hospital at Brooklyn, N. Y., for fiscal year 1888.

Articles.	James J. Lyons.	John Harrison.	W. H. Belford.	W J. Belford.	George W. Child.	John McNamara.	Richard Schierenbeck.	W. Wright.	John Hanley.	Anton Behlen.	Andrew Koch.	Knickerbocker Ice Company.
CLASS I.												
Bacon, sides, sugar-cured ..... per pound	$0.11	$0.10							$0.08			
Beef, corned, Baltimore, extra family ..... do	.06	.06							.06			
Beef, roasting (exclusive of flank, neck, shoulder, or round pieces) ..... do	.12	.12							.10			
Beef-steak, prime cuts ..... do	.14	.08							.10			
Beef, round, clear, no shin or flank ..... do	.10	.10							.08			
Beef-shins ..... do	.05	.04							.03			
Chickens, full-grown, killed and dressed ..... do	.14	.08							.10			
Chickens, spring ..... do	.18	.08							.10			
Fish, fresh ..... do	.07	.06							.04			
Liver, fresh ..... do	.03	.02							.02			
Mutton, prime, fore and hind quarters in equal number ..... do	.09	.06							.06			
Mutton-chops ..... do	.12	.08							.06			
Oysters, fresh and large ..... per quart	.20	.10							.10			
Pork, salt ..... per pound	.09	.06							.05			
Pork, fresh ..... do	.09	.06							.08			
Pork-sausage ..... do	.09	.06							.08			
Pork-steak ..... do	.09	.12							.08			
Turkey, killed and dressed ..... do	.14	.06							.12			
Veal, hind quarter ..... do	.12	.06							.12			
CLASS II.												
Axle-grease ..... per box		$0.10	$0.10				$0.08				$0.10	
Apples ..... per barrel		2.00	1.70				1.70				1.65	
Apples, dried ..... per pound		4.00	.08				.06				.10	
Beans, dried, mediums, white ..... per bushel		2.00	1.75				1.75				1.75	
Beer, lager ..... per dozen		.50	.55				.50				.50	
Brooms, corn, No. 1, patent ..... do		3.00	2.48				2.50				2.50	
Buckets, water, oak, 3-hoop ..... do		6.00	2.60				2.00				2.00	
Bath-brick ..... do		1.00	.35				.40				.35	
Brushes, stove ..... do		1.00	1.00				2.00				2.00	
Brushes, scrubbing ..... do		1.50	1.10				1.00				1.00	
Brushes, dust, long-handled ..... do		4.00	1.75				2.75				2.50	
Barley, pearl ..... per pound		4.00	.03½				.02½				.02½	
Bluing, laundry, pint bottles ..... per dozen		.60	.75				.80				.75	

CLASS VI.												
Bread, fresh, 1-pound loaves........per pound	......	.03	......	......	......	.03¼	.03⅛	......	.03⅛	.02¾	......	......
CLASS VII.												
Bran........per 100 pounds	......	1.00	1.00	......	.95	......	......	......	......	......	1.10	......
Corn (horse-feed)........per bushel	......	.60	.65	......	.70	......	......	......	......	......	.70	......
Corn meal, unbolted, yellow........per 100 pounds	......	1.50	1.37	......	1.10	......	......	......	......	......	1.40	......
Feed, fine........do	......	1.00	.75	......	.95	......	......	......	......	......	.90	......
Hay, loose, best timothy........do	......	1.00	1.15	......	1.35	......	......	......	......	......	1.30	......
Hay, baled, best timothy........do	......	1.00	1.20	......	1.25	......	......	......	......	......	1.25	......
Oats, No. 1, white........per bushel	......	.50	.60	......	.50	......	......	......	......	......	.55	......
Straw, baled........per 100 pounds	......	.50	1.05	......	.90	......	......	......	......	......	1.15	......
Shorts........per bushel	......	.25	.05	......	.20	......	......	......	......	......	.05	......
Screenings........do	......	.10	.53	......	.40	......	......	......	......	......	.55	......
CLASS VIII.												
Gas........per 1,000 feet	......	2.00	......	......	......	......	......	......	......	......	......	......
CLASS IX.												
Water........per gallon	......	.02	......	......	......	......	......	......	......	......	......	......

Class I, awarded to John Hanley; Class II, awarded to Andrew Koch; Classes III and VII, awarded to John Harrison; Class IV, awarded to W. J. Belford; Class V, awarded to W. Wright; Class VI, awarded to Anton Beblen.

Proposals for supplying the naval hospital at Brooklyn, N. Y., for fiscal year 1888—Continued.

Articles.	James J. Lyons.	John Harrison.	W. H. Belford.	W. J. Belford.	George W. Child.	John McNamara.	Richard Schierenbeck.	W. Wright.	John Hanley.	Anton Behlen	Andrew Koch.	Knickerbocker Ice Company.
CLASS II.—Continued.												
Soap, salt-water .... per pound	....	$0.05	$0.06	....	....	....	$0.03	....	....	....	$0.05	....
Soap, toilet .... per box	....	.15	.20	....	....	....	.25	....	....	....	.25	....
Soap, soft .... per barrel	....	1.00	1.40	....	....	....	1.60	....	....	....	.75	....
Starch, corn .... per pound	....	.10	.08	....	....	....	.07	....	....	....	.07	....
Sapolio .... per dozen	....	.10	.75	....	....	....	.75	....	....	....	.70	....
Starch, laundry .... per pound	....	.05	.05½	....	....	....	.04	....	....	....	.04	....
Spices, assorted .... do	....	.25	.15	....	....	....	.30	....	....	....	.30	....
Sugar, white, standard block .... do	....	.07	.07½	....	....	....	.07	....	....	....	.06½	....
Sugar, granulated, standard .... do	....	.03	.07⅓	....	....	....	.06½	....	....	....	.06½	....
Sugar, yellow, light .... do	....	.06	.06	....	....	....	.05¼	....	....	....	.05½	....
Soda, washing .... do	....	.01	.01½	....	....	....	.01½	....	....	....	.01½	....
Squash .... do	....	1.00	1.50	....	....	....	1.00	....	....	....	.10	....
Tomatoes, fresh .... per bushel	....	.25	.40	....	....	....	.75	....	....	....	.25	....
Turnips .... per barrel	....	1.00	1.25	....	....	....	1.00	....	....	....	.20	....
Tapioca .... per pound	....	.06	.05	....	....	....	.06	....	....	....	.04	....
Tea, Oolong, best .... do	....	.28	.27	....	....	....	.25	....	....	....	.27	....
Tomatoes, 3-pound tins .... per dozen	....	.10	1.10	....	....	....	1.10	....	....	....	1.05	....
Vermicelli .... per pound	....	.10	.08	....	....	....	.10	....	....	....	.10	....
Vinegar, best cider .... per gallon	....	.20	.15	....	....	....	.15	....	....	....	.13	....
Vanilla essence, 4-ounce bottles .... per dozen	....	2.00	1.20	....	....	....	1.00	....	....	....	1.05	....
Wax tapers, lighting .... per box	....	.50	.15	....	....	....	.23	....	....	....	.22	....
CLASS III.												
Butter, choice, new creamery .... per pound	....	.25	.22¾	....	....	....	.23	....	....	....	.23	....
Cheese, primo .... do	....	.12	.01½	....	....	....	.02	....	....	....	.02	....
Eggs, fresh and large .... per dozen	....	.15	.22¾	....	....	....	.22	....	....	....	.23	....
CLASS IV.												
Ice .... per pound	....	.50	....	$0.1345	....	....	....	....	....	....	....	$0.13½
CLASS V.												
Milk, pure .... per quart	....	.10	....	....	....	....	.04½	$0.04½	....	....	....	....

Proposals for supplying the naval hospital at Philadelphia for fiscal year 1888.—Cont'd.

Articles.	Frederick Shuler.	Philip I. Badamer.	Robert McKeown.	Knickerbocker Ice Co.	John T. Strickland.	William Deering.	Commercial Ice Co.
CLASS II—Continued.							
Farina .... per pound..	$0.06	$0.06½	$0.06	......	......	$0.09½	......
Flour, best quality .... per barrel..	7.50	6.00	6.00	......	......	5.75	......
Fish, salt .... per pound..	.02	.05	.05	......	......	.05½	......
Greens .... per bushel..	.50	.75	.10	......	......	1.00	......
Gelatine, 2-ounce packages .... per dozen..	1.55	1.55	1.50	......	......	1.65	......
Hominy .... per pound..	.03	.04½	.01	......	......	.02	......
Hams, prime, sugar-cured .... do....	.15	.12½	.13	......	......	.13½	......
Lard, prime, in tubs .... do....	.10	.07½	.01	......	......	.09	......
Lemon essence, 4-ounce bottles ... per dozen..	2.50	2.35	1.25	......	......	2.10	......
Lemons .... do....	.25	.15	.20	......	......	.40	......
Lye, concentrated .... do....	1.25	.90	.70	......	......	1.00	......
Macaroni .... per pound..	.15	.09	.08	......	......	.10	......
Mustard, Coleman's best .... do....	.50	.42½	.20	......	......	.19	......
Molasses, N. O. choice .... per gallon..	.75	.55	.40	......	......	.75	......
Matches, safety .... per gross..	1.50	1.25	1.25	......	......	2.20	......
Mackerel, No. 1 .... per ½-barrel..	15.00	13.00	10.00	......	......	11.00	......
Onions .... per bushel..	2.00	.90	1.00	......	......	1.10	......
Oatmeal .... per 100 pounds..	4.00	3.25	3.50	......	......	3.00	......
Oranges .... per dozen..	.60	.25	.20	......	......	.30	......
Oil, sperm .... per gallon..	.80	.70	.75	......	......	2.50	......
Oil, salad, 8-ounce bottles .... per bottle..	.50	.55	.67	......	......	.33	......
Oil, Pratt's astral .... per gallon..	.25	.50	.75	......	......	.23	......
Parsnips .... per bushel.	.50	.90	.10	......	......	1.50	......
Peas, green .... do....	1.00	1.25	.50	......	......	1.65	......
Potatoes, Irish, early rose .... do....	1.10	.75	.80	......	......	.85	......
Potatoes, sweet .... do....	1.60	.90	.75	......	......	.85	......
Peaches, canned, two-pound tins.. per dozen..	2.00	1.65	1.25	......	......	1.50	......
Pepper, black, ground .... per pound..	.20	.19	.14	......	......	.18	......
Peas, canned, two-pound tins .... per dozen..	1.00	1.20	1.00	......	......	1.40	......
Pickles, mixed .... per bucket..	1.25	1.50	1.10	......	......	1.10	......
Powder, baking, Royal .... per pound..	.50	.42	.10	......	......	.48	......
Powder, Persian insect .... do....	.60	.65	.50	......	......	.80	......
Prunes .... do....	.10	.06½	.09	......	......	.06½	......
Rice, choice .... do....	.07	.06½	.06	......	......	.06½	......
Raisins, layer .... do....	.25	.20	.10	......	......	.20	......
Salt, table .... do....	.02	.01½	.01½	......	......	.01	......
Salt, coarse .... per bushel..	.01½	.05	.40	......	......	.60	......
Soap, laundry, Higgins' best .... per pound..	.05½	.06½	.04¼	......	......	.05½	......
Soap, salt-water .... do....	.75	.10	.02	......	......	.10	......
Soap, toilet .... per box..	1.25	.45	.15	......	......	1.40	......
Soap, soft .... per barrel..	1.50	1.10	1.00	......	......	1.15	......
Starch, corn .... per pound..	.05	.08	.06½	......	......	.08	......
Sapolio .... per dozen.	1.00	1.00	.85	......	......	1.00	......
Starch, laundry .... per pound..	.06	.03¾	.05	......	......	.05	......
Spices, assorted .... do....	.25	.23	.25	......	......	.28	......
Sugar, white, standard block .... do..	.09	.07	.07	......	......	.08	......
Sugar, granulated, standard .... do....	.08	.06	.0[illegible]	......	......	.06½	......
Sugar, yellow, light .... do....	.06	.05	.0[illegible]	......	......	.05½	......
Soda, washing .... do....	.02	.01¾	.01½	......	......	.01¾	......
Squash .... per hundred.	2.00	2.00	1.00	......	......	1.00	......
Tomatoes, fresh .... per bushel	1.00	.90	.40	......	......	.70	......
Turnips .... per barrel..	1.50	2.25	.40	......	......	2.50	......
Tapioca .... per pound.	.08	.04½	.06	......	......	.06	......
Tea, Oolong, best .... do..	.60	.45	.30	......	......	.38	......
Tomatoes, three-pound tins .... per dozen.	1.20	1.50	.90	......	......	1.05	......
Vermicelli .... per pound	.15	.10	.07	......	......	.11	......
Vinegar, best cider .... per gallon..	.25	.15	.11	......	......	.23	......
Vanilla essence, four-ounce bottles per dozen..	5.00	5.25	2.00	......	......	2.10	......
Wax tapers, lighting .... per box..	.25	.25	.18	......	......	.20	......
CLASS III.							
Butter, choice, new creamery .... per pound..	......	......	.28	......	$0.25	.25	......
Cheese, prime .... do..	......	......	.01	......	.03	.13	......
Eggs, fresh and large .... per dozen..	......	......	.24	......	.20	.28	......
CLASS IV.							
Ice .... per 100 pounds	......	......	......	$0.30	.20	......	$0.30
CLASS V.							
Milk, pure .... per quart..	......	......	......	......	.06½	......	......
CLASS VI.							
Bread, fresh, 1-pound loaves .... per pound..	......	......	.03½	......	.05½	......	......

Classes I, IV, and V awarded to John T. Strickland. Classes II, III, and VI awarded to Robert McKeown.

Proposals for supplying the naval laboratory, Brooklyn, for fiscal year 1888.

Articles.	John Harrison.	W. H. Belford.	Geo. W. Child.	Andrew Koch.
CLASS VII.				
Bran .... per pound..	$1.00	$1.00	$0.95	$1.10
Corn (horse-feed) .... per bushel..	.60	.65	.70	.70
Corn-meal, unbolted, yellow .... per pound..	1.15	1.37	1.10	1.40
Feed, fine .... do....	1.00	.75	.95	.90
Hay, loose, best timothy .... per 100 pounds..	1.00	1.15	1.35	1.30
Hay, baled, best timothy .... do....	1.00	1.20	1.25	1.30
Oats, No. 1, white .... per bushel..	.50	.60	.50	.55
Straw, baled .... per 100 pounds..	.50	1.05	.90	1.15
Shorts .... per bushel..	.25	.05	.20	.65
Screenings .... do....	.10	.53	.40	.55

Class VII awarded to John Harrison.

Proposals for supplying the naval hospital at Philadelphia for fiscal year 1888.

Articles.	Frederick Shuler.	Philip L. Badamer.	Robert McKeown.	Knickerbocker Ice Co.	John T. Strickland.	William Deering.	Commercial Ice Co.
CLASS I.							
Bacon, sides, sugar-cured .... per pound..	......	......	......	......	$0.10	......	......
Beef, corned, Baltimore, ex. family .... do....	......	......	......	......	.10	......	......
Beef, roasting (exclusive of flank, neck, shoulder, or round pieces) .... per pound..	......	......	......	......	.16	......	......
Beefsteak, prime cuts .... do....	......	......	......	......	.22	......	......
Beef, round, clear, no shin or flank .... do....	......	......	......	......	.14	......	......
Beef-shins .... do....	......	......	......	......	.02	......	......
Chickens, full-grown, killed and dressed .... do....	......	......	......	......	.18	......	......
Chickens, spring .... do....	......	......	......	......	.30	......	......
Fish, fresh .... do....	......	......	......	......	.10	......	......
Liver, fresh .... do....	......	......	......	......	.02	......	......
Mutton, prime, fore and hind quarters in equal number .... per pound..	......	......	......	......	.10	......	......
Mutton-chops .... do....	......	......	......	......	.16	......	......
Oysters, fresh and large .... per hundred..	......	......	......	......	1.00	......	......
Pork, salt .... per pound..	......	......	......	......	.10	......	......
Pork, fresh .... do....	......	......	......	......	.08	......	......
Pork sausage .... do....	......	......	......	......	.10	......	......
Pork steak .... do....	......	......	......	......	.12	......	......
Turkey, killed and dressed .... do....	......	......	......	......	.15	......	......
Veal, hind quarter .... do....	......	......	......	......	.10	......	......
CLASS II.							
Apples .... per barrel..	$5.00	$3.00	$3.00	......	......	$3.50	......
Apples, dried .... per pound..	.15	.06	.05	......	......	.10	......
Beans, dried, medium, white .... per bushel..	2.40	1.90	2.00	......	......	1.85	......
Beer, lager .... per dozen..	.90	1.00	.62	......	......	.75	......
Brooms, corn, No. 1, patent .... do....	3.50	2.50	2.50	......	......	3.50	......
Buckets, water, oak, 3-hoop .... do....	3.75	3.50	1.80	......	......	3.00	......
Bath-brick .... do....	.50	.90	.35	......	......	.83	......
Brushes, stove .... do....	3.50	2.00	2.50	......	......	3.50	......
Brushes, scrubbing .... do....	3.50	.75	1.25	......	......	2.50	......
Brushes, dust, long-handled .... do....	7.50	3.00	3.00	......	......	4.50	......
Barley, pearl .... per pound..	.05	.03½	.03½	......	......	.04	......
Bluing, laundry, pint bottles .... per dozen..	2.50	1.40	1.00	......	......	1.10	......
Beans, string .... per bushel..	1.50	1.50	.50	......	......	3.00	......
Blacking, stove .... per pound..	.25	.09	.50	......	......	.17	......
Beets .... per bushel..	1.00	1.00	.01½	......	......	1.25	......
Cranberries .... do....	3.50	3.00	1.00	......	......	2.20	......
Carrots .... per barrel..	1.80	2.50	.12	......	......	2.50	......
Cabbage, large heads .... per dozen..	1.50	.75	.30	......	......	.60	......
Corn, sweet-ears .... per hundred..	1.50	2.00	1.00	......	......	1.50	......
Chocolate, Baker's .... per pound..	.40	.36	.37	......	......	.38	......
Corn-meal, yellow, bolted .... per 100 pounds..	2.00	2.00	1.50	......	......	1.50	......
Coffee, prime Rio, whole, roasted .... per pound..	.30	.22	.20	......	......	.26	......
Corn, canned, 2-pound tins .... per dozen..	1.60	1.20	1.00	......	......	1.05	......
Clothes-pins .... per gross..	.30	.25	.15	......	......	.25	......
Candles, adamantine .... per pound..	.15	.11	.12	......	......	.12	......
Crackers, water .... do....	.10	.08	.08	......	......	.08	......

Proposals for supplying the naval hospital at Washington, D. C., etc.—Continued.

Articles.	Browning & Middleton.	J. B. Bryan.	F. P. Seibert.	George M. Oyster & Co.
CLASS II—Continued.				
Oil, Pratt's astral ... per gallon	$0.18	$0.20	....	....
Parsnips ... per bushel	.50	.75	....	....
Peas, green ... do	.50	1.00	....	....
Potatoes, Irish, early rose ... per barrel	2.50	2.20	....	....
Potatoes, sweet ... do	2.00	2.45	....	....
Peaches, canned, 2-pound tins ... per dozen	1.25	1.70	....	....
Pepper, black, ground ... per pound	.24	.18	....	....
Peas, canned, 2 pound tins ... per dozen	1.25	1.80	....	....
Pickles, mixed ... per pound	.10	.12	....	....
Powder, baking, Royal ... do	.42	.40	....	....
Powder, Persian insect ... do	.30	.55	....	....
Prunes ... do	.05	.06	....	....
Rice, choice ... do	.06	.05½	....	....
Raisins, layer ... do	.10	.14	....	....
Salt, table ... do	.01	.00¾	....	....
Salt, coarse ... per bushel	.50	.55	....	....
Soap, laundry, Higgins' best ... per pound	.04½	.05	....	....
Soap, salt-water ... do	.08	.10	....	....
Soap, toilet ... per box	.25	.60	....	....
Soap, soft ... per barrel	2.00	2.10	....	....
Starch, corn ... per pound	.07	.05	....	....
Sapolio ... per dozen	.90	.98	....	....
Starch, laundry ... per pound	.04	.04½	....	....
Spices, assorted ... do	.25	.35	....	....
Sugar, white, standard block ... do	.07½	.07	....	....
Sugar, granulated, standard ... do	.06¼	.06¼	....	....
Sugar, yellow, light ... do	.05	.05	....	....
Soda, washing ... do	.01¼	.01¼	....	....
Squash ... do	.50	3.75	....	....
Tomatoes, fresh ... per bushel	.75	.90	....	....
Turnips ... per barrel	.50	1.10	....	....
Tapioca ... per pound	.06½	.08	....	....
Tea, Oolong best ... do	.35	.55	....	....
Tomatoes, 3 pound tins ... per dozen	.92	.89	....	....
Vermicelli ... per pound	.10½	.10	....	....
Vinegar, best cider ... per gallon	.19	.16	....	....
Vanilla essence, 4 ounce bottles ... per dozen	3.00	3.00	....	....
Wax tapers, lighting ... per box	15	.15	....	....
CLASS III.				
Butter, choice, new creamery ... per pound	.29	.29	....	$0.29
Cheese, prime ... do	.10	.12	....	.15
Eggs, fresh and large ... per dozen	24	.22	....	.28
CLASS IV.				
Ice ... per 100 pounds	.40	....	....	....
CLASS V.				
Milk, pure ... per quart	.06	....	....	....
CLASS VI.				
Bread, fresh, 1 pound loaves ... per pound	.01¾	....	....	....

Class I awarded to F. P. Seibert. Classes II, IV, V, and VI awarded to Browning & Middleton. Class III awarded to J. B. Bryan.

Proposals for supplying the naval hospital at Washington, D. C., for fiscal year 1882.

Articles.	Browning & Middleton.	J. B. Bryan.	F. P. Seibert.	George M. Oyster & Co.
CLASS I.				
Bacon, sides, sugar-cured .... per pound..	$0.09		$0.12	
Beef, corned, Baltimore, extra family .... do....	.08		.07	
Beef, roasting (exclusive of flank, neck, shoulder, or round pieces) .... per pound..	.15		.12½	
Beef-steak, prime cuts .... do....	.19		.18	
Beef, round, clear, no shin or flank .... do....	.15		.12½	
Beef-shins .... do....	.05		.03	
Chickens, full-grown, killed and dressed .... do....	.16		.16	
Chickens, spring .... do....	.18		.16	
Fish, fresh .... do....	.12½		.13	
Liver, fresh .... do....	.10		.02	
Mutton, prime, fore and hind quarters in equal number. do....	.15		.12	
Mutton-chops .... do....	.15		.15	
Oysters, fresh and large .... per quart..	.31½		.20	
Pork, salt .... per pound..	.11½		.08	
Pork, fresh .... do....	.11½		.10	
Pork-sausage .... do....	.11½		.09	
Pork-steak .... do....	.11½		.09	
Turkey, killed and dressed .... do....	.18		.22	
Veal, hind quarter .... do....	.15		.12½	
CLASS II.				
Axle-grease .... per box..	.00½	$0.06		
Apples .... per barrel..	3.00	3.25		
Apples, dried .... per pound..	.06	.05½		
Beans, dried, medium, white .... per bushel..	1.90	2.10		
Beer, lager .... per dozen..	.70	.50		
Brooms, corn, No. 1, patent .... do....	2.75	2.50		
Buckets, water, oak, 3-hoop .... do....	1.75	3.40		
Bath-brick .... do....	.05	.50		
Brushes, stove .... do....	1.50	1.60		
Brushes, scrubbing .... do....	1.25	1.25		
Brushes, dust, long-handled .... do....	12.00	13.00		
Barley, pearl .... per pound..	.05	.04½		
Bluing, laundry, pint bottles .... per dozen..	.70	1.00		
Beans, string .... per bushel..	.50	1.62		
Blacking, stove .... per pound..	.15	.25		
Beets .... per bushel..	1.00	1.00		
Cranberries .... do....	2.25	2.15		
Carrots .... per barrel..	2.50	1.65		
Cabbage, large heads .... per dozen..	1.20	1.40		
Corn, sweet-ears .... number..	1.50	1.35		
Chocolate, Baker's .... per pound..	.37	.37½		
Corn-meal, yellow, bolted .... per 100 pounds..	2.12½	1.25		
Coffee, prime Rio, whole, roasted .... per pound..	.20	.24½		
Corn, canned, 2-pound tins .... per dozen..	.95	.95		
Clothes-pins .... per gross..	.10	.35		
Candles, adamantine .... per pound..	.08	.11		
Crackers, water .... do....	.06	.08		
Farina .... do....	.10	.10		
Flour, best quality .... per barrel..	5.75	5.00		
Fish, salt .... per pound..	.05	.05½		
Greens .... per bushel..	.25	.60		
Gelatine, 2-ounce packages .... per dozen..	1.56	1.63		
Hominy .... per pound..	.02½	.02		
Hams, prime, sugar cured .... do....	.12½	.12½		
Lard, prime, in tubs .... do....	.07½	.07½		
Lemon essence, 4-ounce bottles .... per dozen..	2.50	3.00		
Lemons .... do....	.25	.18		
Lye, concentrated .... do....	.75	.75		
Macaroni .... per pound..	.10½	.09		
Mustard, Coleman's best .... do....	.25	.40		
Molasses, N. O. choice .... per gallon..	.40	.39		
Matches, safety .... per gross..	1.00	2.05		
Mackerel, No. 1 .... per barrel..	10.00	9.15		
Onions .... per bushel..	2.00	1.50		
Oatmeal .... per 100 pounds..	3.25	3.18		
Oranges .... per dozen..	.35	.33		
Oil, sperm .... per gallon..	1.00	1.10		
Oil, salad, 8-ounce bottles .... per bottle..	.35	.25		

Bluing, laundry, pint bottles	per dozen			.10			1.23	1.25			1.00		
Beans, string	per bushel			1.00			.80	.75			1.05		
Blacking, stove	per pound			.15			.20	.15			.25		
Beets	per bushel			2.00			.80	.75			1.50		
Cranberries	do			4.00			2.00	3.00			4.00		
Carrots	per barrel			2.50			1.50	2.25			1.75		
Cabbage, large heads	per dozen			1.50			.98	1.00			1.75		
Corn, sweet ears	number			1.20			.97	1.00			1.10		
Chocolate, Baker's	per pound			.40			.38	.45			.40		
Corn-meal, yellow, bolted	do			.60			1.00	1.20			1.40		
Coffee, prime Rio, whole, roasted	do			.20			.28	.28			.25		
Corn, canned, 2 pound tins	per dozen			1.00			1.10	1.00			1.25		
Clothes pins	per gross			.15			.15	.15			.30		
Candles, adamantine	per pound			.13			.15	.13			.20		
Crackers, water	do			.15			.05	.07			.04		
Farina	do			.10			.06	.08			.10		
Flour, best quality	per barrel			5.50			6.00	5.00			6.00		
Fish, salt	per pound			.04			.05	.05			.10		
Greens	per bushel			.80			.40	.40			.60		
Gelatine, 2 ounce packages	per dozen			1.20			1.25	1.50			1.50		
Hominy	per pound			.02½			.03	.03			.03		
Hams, prime, sugar-cured	do			.13½			.14	.14			.14		
Lard, prime, in tubs	do			.09			.08	.09			.09		
Lemon essence, 4 ounce bottles	per dozen			1.60			2.00	1.75			.80		
Lemons	do			.16			.20	.25			.25		
Lye, concentrated	do			.90			.89	.90			.85		
Macaroni	per pound			.10			.09	.10			.12		
Mustard, Coleman's best	do			.65			.40	.45			.50		
Molasses, New Orleans choice	per gallon			.45			.40	.45			.45		
Matches, safety	per gross			.65			.80	.70			.90		
Mackerel, No. 1	per barrel			12.00			10.75	10.00			8.00		
Onions	per bushel			1.50			1.25	1.25			1.50		
Oatmeal	per pound			.03½			4.00	3.75			4.50		
Oranges	per dozen			.20			.30	.35			.50		
Oil, sperm	per gallon			1.25			1.48	1.50			1.75		
Oil, salad, 8-ounce bottles	per bottle			.20			.19	.25			.45		
Oil, Pratt's astral	per gallon			.15			.20	.18			3.50		
Parsnips	per bushel			1.50			.78	.90			2.00		
Peas, green	do			1.20			.90	.90			1.80		
Potatoes, Irish, Early Rose	per barrel			3.00			2.00	2.70			2.50		
Potatoes, sweet	do			1.75			2.00	1.75			1.50		
Peaches, canned, 2-pound tins	per dozen			1.00			1.10	1.25			1.40		
Pepper, black, ground	per pound			.20			.24	.20			.30		
Peas, canned, 2-pound tins	per dozen			1.10			1.38	1.40			1.25		
Pickles, mixed	per pound			.08			.07	.07			.10		
Powder, baking, Royal	do			.60			.40	.40			.16		
Powder, Persian insect	do			.50			.30	.50			.50		
Prunes	do			.08			.06	.07			.08		
Rice, choice	do			.07			.06¾	.06			.06		
Raisins, layer	do			.14			.13	.12			.12		
Salt, table	do			.00¾			.01	.00⅝			.01½		
Salt, coarse	per bushel			.25			.25	.30			.01		

Proposals for supplying naval hospital at Norfolk, Va., for fiscal year 1888.

Articles.	Conrad Horst.	John A. Codd.	J. T. Parker.	W. G. Maupin.	Kate C. Brady.	L. Morris.	Thomas J. Barlow.	Charles R. Robertson.	Niemeyer & Co.	O. L. Williams.	R. T. Mules.	C. R. Nash.
CLASS I.												
Bacon, sides, sugar-cured ... per pound	$0.0920	$0.0745					$0.10	$0.099				
Beef, corned, Baltimore, extra family ... do	.520	.0745					.08	.06				
Beef, roasting (exclusive of flank, neck, shoulder, or round pieces) ... do	.720	.0745					.10	.067				
Beef-steak, primo cuts ... do	.08	.0745					.10	.067				
Beef, round, clear, no shin or flank ... do	.08	.0745					.10	.067				
Beef-shins ... do	.04	.0745					.05	.03				
Chickens, full-grown, killed and dressed ... do	.16	.20					.18	.15				
Chickens, spring ... do	.16	.20					.20	.25				
Fish, fresh ... do	.0409	.06					.07	.05				
Liver, fresh ... do	.06	.0745					.10	.06				
Mutton, prime, fore and hind quarters in equal number ... do	.07	.0745					.10	.067				
Mutton-chops ... do	.09	.0745					.10	.067				
Oysters, fresh and large ... per quart	.24	.20					.30	.22				
Pork, salt ... per pound	.0709	.0845					.10	.084				
Pork, fresh ... do	.07	.0845					.10	.09				
Pork-sausage ... do	.08	.0845					.10	.08				
Pork-steak ... do	.08	.0845					.10	.09				
Turkey, killed and dressed ... do	.14	.15					.18	.16				
Veal, hind quarter ... do	.10	.0745					.10	.10				
CLASS II.												
Axle-grease ... per box			$0.06			$0.05	.06			$0.06		
Apples ... per barrel			3.00			2.00	3.50			3.50		
Apples, dried ... per pound			.05			.04½	.05			.08		
Beans, dried, medium, white ... per bushel			1.75			2.00	2.00			1.50		
Beer, lager ... per dozen			.65			.55	.57½			.50		
Brooms, corn, No. 1, patent ... do			3.50			3.25	3.00			2.25		
Buckets, water, oak, 3-hoop ... do			2.00			3.50	4.50			1.50		
Bath-brick ... do			.80			.15	.25			.15		
Brushes, stove ... do			2.00			1.10	1.50			1.00		
Brushes, scrubbing ... do			1.00			1.25	1.00			.50		
Brushes, dust, long-handled ... do			4.00			5.70	6.00			3.00		
Barley, pearl ... per pound			.05			.05	.05			.08		

CLASS V.													
Milk, pure	per quart	....	$0.08½	....	....	$0.07	....	$0.06	$0.0795	....	....	....	....
CLASS VI.													
Bread, fresh, 1 pound loaves	per pound	....	....	$0.05	....	....	....	.03½	....	....	....	$0.04	....
CLASS VII.													
Bran	per pound	....	....	....	....	....	$0.85	.90	....	$1.10	$1.05	....	....
Corn (horse-feed)	per bushel	....	....	....	....	....	.60	.63	....	.64	.65	....	....
Corn-meal, unbolted, yellow	per pound	....	....	....	....	....	.50	1.20	....	1.20	1.30	....	....
Feed, fine	do	....	....	....	....	....	.75	1.00	....	1.50	.80	....	....
Hay, loose, best timothy	do	....	....	....	....	....	.60	.80	....	.93½	.85	....	....
Hay, baled, best timothy	do	....	....	....	....	....	.60	.90	....	.97½	.90	....	....
Oats, No. 1, white	per bushel	....	....	....	....	....	.48	.45	....	.47½	.45	....	....
Straw, baled	per pound	....	....	....	....	....	.50	.60	....	.80	.50	....	....
Shorts	per bushel	....	....	....	....	....	.25	.40	....	.50	.33	....	....
Screenings	do	....	....	....	....	....	.40	.50	....	.60	.40	....	....

Class I, awarded to Charles R. Robertson; Classes II, III, and VII, awarded to L. Morris; Class IV, awarded to W. G. Maupin; Class V, awarded to Kate C. Brady; Class VI, awarded to Thomas J. Barlow

Proposals for supplying naval hospital at Pensacola, Fla., for fiscal year 1888.

Articles.	Fred. Bauer.	R. A. Phillibert.	Benj. Dolphin.	T. J. Mooney.	Chas. E. Baker.
Class I.					
Bacon, sides, sugar-cured .... per pound..	$0.12	$0.10	$0.10	$0.10½	$0.12½
Beef, corned, Baltimore, extra family .... do....	.09	.10	.10	.10	.11
Beef, roasting (exclusive of flank, neck, shoulder, or round pieces) .... per pound..	.13	.13	.12½	.13½	.16
Beefsteak, prime cuts .... do....	.13	.13	.12½	.14	.16
Beef, round, clear, no skin or flank .... do....	.13	.13	.12½	.14	.12½
Beef shins .... do...	.07	.05	.04	.05	.15
Chickens, full-grown, killed and dressed .... do....	.20	.15	.12½	.15	.12
Chickens, spring .... do....	.20	.15	.08	.12½	.12
Fish, fresh .... do....	.07	.04	.04	.04	.05
Liver, fresh .... do...	.13	.10	.10	.13½	.15
Mutton, prime, fore and hind quarters in equal number. do....	.15	.13	.15	.14	.16
Mutton-chops .... do....	.15	.13	.15	.15	.16
Oysters, fresh and large .... per quart..	.40	.30	.50	.55	.25
Pork, salt .... per pound..	.10	.10	.10	.10	.08
Pork sausage .... do....	.18	.15	.17	.17	.18
Turkey, killed and dressed .... do....	.20	.15	.20	.19	.12½
Veal, hind quarter .... do....	.15	.13	.12½	.14	.16
Class II.					
Axle-grease .... per box..	.10	.08	....	.10	.08
Apples .... per barrel..	4.50	2.00	....	2.50	2.50
Apples, dried .... per pound..	.12	.08	....	.09	.08
Beans, dried, mediums, white .... per bushel..	2.75	2.25	....	2.50	2.40
Beer, lager .... per dozen..	1.35	1.00	....	1.00	1.25
Brooms, corn, No. 1, patent .... do ..	3.25	3.00	....	3.50	4.80
Buckets, water, oak, 3-hoop .... do....	2.75	2.75	....	2.00	5.50
Bath-brick .... do....	1.00	.60	....	.75	.75
Brushes, stove .... do....	2.50	1.75	....	2.20	1.75
Brushes, scrubbing .... do....	2.50	1.75	....	2.00	1.90
Brushes, dust, long-handled .... do....	.50	1.75	....	2.50	6.00
Barley, pearl .... per pound..	.08	.05	....	.05	.05
Bluing, laundry, pint bottles .... per dozen..	1.50	1.00	....	1.50	.75
Beans, string .... per bushel..	1.50	1.50	....	1.00	.75
Blacking, stove .... per pound..	.15	.10	....	.40	.10
Beets .... per bushel..	1.75	1.40	....	1.40	1.40
Cranberries .... do....	2.75	3.25	....	2.00	1.60
Carrots .... per barrel..	3.00	3.00	....	2.00	2.00
Cabbage, large heads .... per dozen..	2.40	2.00	....	2.40	2.00
Corn, sweet, ears .... per 100..	3.00	1.00	....	2.50	2.00
Chocolate, Baker's .... per pound..	.30	.30	....	.35	.30
Corn-meal, yellow, bolted .... per 100 pounds..	1.60	1.70	....	1.70	1.00
Coffee, prime, Rio, whole, roasted .... per pound..	.27	.25	....	.17	.25
Corn, canned, 2-pound tins .... per dozen..	1.60	1.80	....	1.80	1.80
Clothes-pins .... per gross .	.50	.50	....	1.00	.50
Candles, adamantine .... per pound..	.13	.15	....	.17	.20
Crackers, water .... do....	.07	.08	....	.10	.05
Farina .... do ..	.10	.08	....	.05	.05
Flour, best quality .... per barrel..	5.75	5.75	....	6.00	5.00
Fish, salt .... per pound..	.06	.08	....	.06	.05
Greens .... per bushel..	.50	.50	....	.60	.20
Gelatine, 2-ounce packages .... per dozen..	2.00	.60	....	1.00	.10
Hominy .... per pound..	.03	.02	....	.03½	.04
Ham, prime, sugar-cured .... do...	.13	.14	....	.14	.15
Lard, prime, in tubs .... do ...	.09	.10	....	.09	.08
Lemon essence, 4-ounce bottles .... per dozen..	1.60	1.75	....	2.00	.75
Lemons .... do ..	.35	.25	....	.30	.25
Lye, concentrated .... do ...	1.00	1.00	....	1.20	1.00
Macaroni .... per pound..	.12	.15	....	.15	.05
Mustard, Coleman's best .... do....	.50	.40	....	.40	.35
Molasses, N. O. choice .... per gallon..	.50	.50	....	.55	.60
Matches, safety .... per gross..	1.10	1.20	....	1.10	.90
Mackerel, No. 1 .... per barrel..	9.00	6.00	....	2.00	4.00
Onions .... per bushel..	1.80	1.50	....	1.60	1.50
Oatmeal .... per pound..	6.00	5.00	....	4.50	4.00
Oranges .... per dozen..	.35	.40	....	.40	.30
Oil, sperm .... per gallon..	1.25	.70	....	.75	.60
Oil, salad, 8-ounce bottles .... per bottle..	.30	.30	....	.35	.30
Oil, Pratt's Astral .... per gallon..	.25	.30	....	.40	.20
Parsnips .... per bushel..	1.25	.85	....	.50	1.00
Peas, green .... do....	1.50	50	....	.80	1.00

Proposals for supplying naval hospital at Pensacola, Fla., etc.—Continued.

Articles.	Fred. Bauer.	B. A. Philibert.	Benj. Dolphin.	T. J. Mooney.	Chas. E. Baker.
Class II—Continued.					
Potatoes, Irish, Early Rose ... per barrel	$2.75	$2.75	....	$2.50	$3.00
Potatoes, sweet ... do	1.80	2.00	....	2.00	2.50
Peaches, canned, two-pound tins ... per dozen	1.75	1.80	....	1.75	2.00
Pepper, black, ground ... per pound	.30	.30	....	.25	.25
Peas, canned, two-pound tins ... per dozen	1.75	1.80	....	1.95	2.00
Pickles, mixed ... per pound	.10	.06	....	.05	.08
Powder, baking, Royal ... do	.50	.40	....	.20	.19
Powder, Persian insect ... do	.50	.50	....	.25	.35
Prunes ... do	.15	.15	....	.10	.15
Rice, choice ... do	.06	.07	....	.07	.05½
Raisins, layer ... do	.17	.18	....	.20	.18
Salt, table ... per 100 pounds	1.90	2.00	....	2.50	3.00
Salt, coarse ... per bushel	.60	.70	....	.55	.50
Soap, laundry, Higgins's best ... per pound	.03	.05	....	.05	.05
Soap, salt-water ... do	.06	.03	....	.06	.04
Soap, toilet ... per box	.50	.25	....	.10	.15
Soap, soft ... per barrel	3.00	1.00	....	.90	1.80
Starch, corn ... per pound	.09	.12	....	.15	.10
Sapolio ... per dozen	1.00	1.00	....	1.00	.85
Starch, laundry ... per pound	.05	.05	....	.06	.03½
Spices, assorted ... do	.25	.25	....	.30	.35
Sugar, white, standard block ... do	.09	.10	....	.10	.10
Sugar, granulated, standard ... do	.07½	.09	....	.09	.08
Sugar, yellow, light ... do	.06½	.09	....	.08	.07½
Soda, washing ... do	.07	.04	....	.05	.04
Squash ... do	3.50	.50	....	1.00	2.00
Tomatoes, fresh ... per bushel	2.50	1.50	....	.50	1.25
Turnips ... per barrel	2.70	2.00	....	2.90	2.00
Tapioca ... per pound	.07	.10	....	.10	.06
Tea, Oolong, best ... do	.60	.50	....	.50	.75
Tomatoes, three-pound tins ... per dozen	1.50	1.80	....	1.10	1.75
Vermicelli ... per pound	.12	.15	....	.15	.15
Vinegar, best cider ... per gallon	.30	.30	....	.35	.50
Vanilla, essence, 4 ounce bottles ... per dozen	1.75	2.40	....	1.75	2.50
Wax tapers, lighting ... per box	....	.25	....	.15	.05
Class III.					
Butter, choice, new creamery ... per pound	.30	.32	$0.30	.30	.40
Cheese, prime ... do	.18	.15	.15	.15	.20
Eggs, fresh and large ... per dozen	.26	.25	.25	.25	.30
Class IV.					
Ice ... per 100 pounds	....	1.00	1.00	1.00	.90
Class V.					
Milk, pure ... per quart	.14	.13½	.13½	.16	.15
Class VI.					
Bread, fresh, 1-pound loaves ... per pound	....	.05	.05	.05	.06¼
Class VII.					
Bran ... per 100 pounds	1.15	1.20	1.15	1.20	.85
Corn (horse-feed) ... per bushel	.70	.75	.70	.70	.70
Hay, baled, best timothy ... per 100 pounds	1.10	1.20	1.18	1.20	1.20
Oats, No. 1, white ... per bushel	.50	.55	.54	.55	.53
Straw, baled ... per 100 pounds	1.20	1.00	1.00	1.00	.90

Classes I and V awarded to Benjamin Dolphin. Classes II, III, and VI awarded to T. J. Mooney. Classes IV and VII awarded to Charles E. Baker.

Proposals for supplying naval hospital at Pensacola, Fla., for fiscal year 1883.

Articles.	Fred. Bauer.	B. A. Philibert.	Benj. Dolphin.	T. J. Moonry.	Chas. E. Baker.
Class I.					
Bacon, sides, sugar-cured .... per pound..	$0.12	$0.10	$0.10	$0.10½	$0.12½
Beef, corned, Baltimore, extra family .... do....	.09	.10	.10	.10	.11
Beef, roasting (exclusive of flank, neck, shoulder, or round pieces) .... per pound..	.13	.13	.12½	.13½	.16
Beefsteak, prime cuts .... do....	.13	.13	.12½	.14	.16
Beef, round, clear, no skin or flank .... do....	.13	.13	.12½	.14	.12½
Beef shins .... do....	.07	.05	.04	.05	.15
Chickens, full-grown, killed and dressed .... do....	.20	.15	.12½	.15	.12
Chickens, spring .... do....	.20	.15	.08	.12½	.12
Fish, fresh .... do....	.07	.04	.04	.04	.05
Liver, fresh .... do....	.13	.10	.10	.13½	.15
Mutton, prime, fore and hind quarters in equal number. do....	.16	.13	.15	.14	.16
Mutton-chops .... do....	.15	.13	.15	.15	.16
Oysters, fresh and large .... per quart..	.40	.30	.50	.55	.25
Pork, salt .... per pound..	.10	.10	.10	.10	.08
Pork sausage .... do....	.18	.15	.17	.17	.18
Turkey, killed and dressed .... do....	.20	.16	.20	.19	.12½
Veal, hind quarter .... do....	.15	.13	.12½	.14	.16
Class II.					
Axle-grease .... per box..	.10	.08	....	.10	.08
Apples .... per barrel..	4.50	2.00	....	2.50	2.50
Apples, dried .... per pound..	.12	.08	....	.09	.08
Beans, dried, mediums, white .... per bushel..	2.75	2.25	....	2.50	2.40
Beer, lager .... per dozen..	1.35	1.00	....	1.00	1.25
Brooms, corn, No. 1, patent .... do...	3.25	3.00	....	3.50	4.80
Buckets, water, oak, 3-hoop .... do....	2.75	2.75	....	2.00	5.50
Bath-brick .... do....	1.00	.60	....	.75	.75
Brushes, stove .... do....	2.50	1.75	....	2.20	1.75
Brushes, scrubbing .... do....	2.50	1.75	....	2.00	1.90
Brushes, dust, long-handled .... do....	.50	1.75	....	2.50	6.00
Barley, pearl .... per pound..	.08	.05	....	.05	.05
Bluing, laundry, pint bottles .... per dozen..	1.50	1.00	....	1.50	.75
Beans, string .... per bushel..	1.50	1.50	....	1.00	.75
Blacking, stove .... per pound..	.15	.10	....	.40	.10
Beets .... per bushel..	1.75	1.40	....	1.40	1.40
Cranberries .... do....	2.75	3.25	....	2.00	1.50
Carrots .... per barrel..	3.00	3.00	....	2.00	2.00
Cabbage, large heads .... per dozen..	2.40	2.00	....	2.40	2.00
Corn, sweet, ears .... per 100..	3.00	1.00	....	2.50	2.00
Chocolate, Baker's .... per pound..	.30	.30	....	.85	.30
Corn-meal, yellow, bolted .... per 100 pounds..	1.60	1.70	....	1.70	1.00
Coffee, prime, Rio, whole, roasted .... per pound..	.27	.25	....	.17	.25
Corn, canned, 2-pound tins .... per dozen..	1.60	1.80	....	1.80	1.85
Clothes-pins .... per gross .	.50	.50	....	1.00	.50
Candles, adamantine .... per pound..	.13	.15	....	.17	.20
Crackers, water .... do....	.07	.08	....	.10	.05
Farina .... do ...	.10	.08	....	.05	.05
Flour, best quality .... per barrel..	5.75	5.75	....	6.00	5.00
Fish, salt .... per pound..	.06	.08	....	.06	.05
Greens .... per bushel..	.50	.50	....	.60	.20
Gelatine, 2-ounce packages .... per dozen..	2.00	.60	....	1.00	.10
Hominy .... per pound..	.03	.02	....	.03½	.04
Ham, prime, sugar-cured .... do...	.13	.14	....	.14	.15
Lard, prime, in tubs .... do ...	.09	.10	....	.09	.08
Lemon essence, 4-ounce bottles .... per dozen..	1.60	1.75	....	2.00	.75
Lemons .... do ..	.35	.25	....	.30	.25
Lye, concentrated .... do ...	1.00	1.00	....	1.20	1.00
Macaroni .... per pound.	.12	.15	....	.15	.05
Mustard, Coleman's best .... do ...	.50	.40	....	.40	.35
Molasses, N. O. choice .... per gallon..	.50	.50	....	.55	.60
Matches, safety .... per gross..	1.10	1.20	....	1.10	.90
Mackerel, No. 1 .... per barrel..	9.00	6.00	....	2.00	4.00
Onions .... per bushel..	1.80	1.50	....	1.60	1.50
Oatmeal .... per pound..	6.00	5.00	....	4.50	4.00
Oranges .... per dozen..	.35	.40	....	.40	.30
Oil, sperm .... per gallon..	1.25	.70	....	.75	.60
Oil, salad, 8-ounce bottles .... per bottle..	.30	.30	....	.35	.30
Oil, Pratt's Astral .... per gallon..	.25	.30	....	.40	.20
Parsnips .... per bushel..	1.25	.85	....	.50	1.00
Peas, green .... do....	1.50	50	....	.80	1.00

Proposals for supplying the naval hospital at Mare Island, Cal., etc.—Continued.

Articles.		M. L. Kelly.	John Brownlie.	J. F. Tobin.	G. W. Wilson.
Potatoes, Irish, Early Rose	per pound	$0.02¾	$0.02½	$0.02½	....
Potatoes, sweet	do	.03	.03	.03	....
Peaches, canned, 2-pound tins	per dozen	2.50	2.10	2.00	....
Pepper, black, ground	per pound	.24	.25	.20	....
Peas, canned, 2-pound tins	per dozen	1.65	1.75	1.60	....
Pickles, mixed	per pound	.09½	.10	.09	....
Powder, baking, Royal	do	.50	.50	.50	....
Powder, Persian insect	do	1.15	1.12½	1.00	....
Prunes	do	.12	.11½	.11	....
Rice, choice	do	.07	.06½	.06	....
Raisins, layer	do	.14	.13	.12½	....
Salt, table	do	.01	.01	.01	....
Salt, coarse	per bushel	.42	.45	.40	....
Soap, laundry, Higgins's best	per pound	.09¼	.09½	.09	....
Soap, salt-water	do	.09¾	.09½	.09	....
Soap, toilet	per box	1.60	1.75	1.50	....
Soap, soft	per barrel	4.50	4.25	4.00	....
Starch, corn	per pound	.09½	.10	.09	....
Sapolio	per dozen	1.75	1.60	1.56	....
Starch, laundry	per pound	.09½	.10	.09	....
Spices, assorted	do	.27½	.26	.25	....
Sugar, white, standard block	do	.09	.08¾	.08½	....
Sugar, granulated, standard	do	.07½	.07½	.07	....
Sugar, yellow, light	do	.07	.06¾	.06½	....
Soda, washing	do	.01½	.01¾	.01¾	....
Squash	per 100 pounds	3.40	3.25	3.00	....
Tomatoes, fresh	per pound	.08½	.08½	.08	....
Turnips	do	.03	.02¾	.02½	....
Tapioca	do	.08½	.08½	.08	....
Tea, Oolong, best	do	.40	.50	.45	....
Tomatoes, 3-pound tins	per dozen	1.75	1.60	1.50	....
Vermicelli	per pound	.11	.10½	.10	....
Vinegar, best cider	per gallon	.28	.30	.25	....
Vanilla essence, 4 ounce bottles	per dozen	3.00	2.75	2.50	....
Wax-tapers, lighting	per box	.28	.30	.25	....
CLASS III.					
Butter, choice, new creamery	per pound	.38	.40	.35	....
Cheese, prime	do	.25	.22	.20	....
Eggs, fresh and large	per dozen	.38	.37½	.35	....
CLASS IV.					
Ice	per 100 pounds	3.25	3.50	3.00	....
CLASS V.					
Milk, pure	per quart	.09	.10	.08	....
CLASS VI.					
Bread, fresh, 1-pound loaves	per pound	.05½	.05½	.05	....
CLASS VII.					
Bran	per 100 pounds	1.35	1.30	1.25	....
Corn (horse-feed)	per bushel	1.30	1.30	1.25	....
Corn meal, unbolted, yellow	per 100 pounds	2.15	2.10	2.00	....
Feed, fine	do	2.15	2.25	2.00	....
Hay, loose, best timothy	do	.85	.80	.75	....
Hay, baled, best timothy	do	1.15	1.25	1.00	....
Oats, No. 1, white	do	2.25	[illegible]	2.25	....
Straw, baled	do	.65	.55	.50	....
Shorts	per bushel	.74	.75	.70	....
Screenings	do	.60	.75	.50	....
CLASS VIII.					
Gas	per 1,000 feet	....	....	....	$2.00
CLASS IX.					
Water	per 100 gallons	....	....	....	.05

Classes I, II, III, IV, V, VI, VII awarded to J. F. Tobin. Classes VIII, IX awarded to G. W. Wilson.

Proposals for supplying the naval hospital at Mare Island, Cal., for fiscal year 1888.

Articles.	M. L. Kelly.	John Brownlie.	J. F. Tobin.	G. W. Wilson.
CLASS I.				
Bacon, sides, sugar-cured ......per pound..	$0.13	$0.13½	$0.13	....
Beef, corned, Baltimore extra family ......do....	.10	.10	.09	....
Beef, roasting (exclusive of flank, neck, shoulder, or round pieces) ......per pound..	.12	.12½	.11	....
Beef-steak, prime cuts ......do....	.14	.13	.11	....
Beef, round, clear, no shin or flank ......do....	.10½	.11	.10	....
Beef-shins ......do....	.09	.10	.08	....
Chickens, full grown, killed and dressed ......do....	.19	.18½	.18	....
Chickens, spring ......do....	.25½	.26	.25	....
Fish, fresh ......do....	.10½	.11	.10	....
Liver, fresh ......do....	.10	.09	.08	....
Mutton, prime, fore and hind quarters in equal number, per pound	.12	.13	.09	....
Mutton-chops ......per pound..	.12½	.13	.12	....
Oysters, fresh and large ......per solid quart..	.80	.80	.75	....
Pork, salt ......per pound..	.09½	.10	.09	....
Pork, fresh ......do....	.13	.12	.10	....
Pork-sausage ......do....	.14	.15	.10	....
Pork-steak ......do....	.12½	.13	.12	....
Turkey, killed and dressed ......do....	.25	.23	.20	....
Veal, hind quarter ......do....	.12	.11	.10	....
CLASS II.				
Axle-grease ......per box..	.20	.18	.16	....
Apples ......per barrel..	2.25	2.50	2.00	....
Apples, dried ......per pound..	.11	.11	.10	....
Beans, dried, mediums, white ......per bushel..	1.40	1.50	1.25	....
Beer, lager ......per dozen..	2.15	2.10	2.00	....
Brooms, corn, No. 1, patent ......do....	5.00	4.75	4.50	....
Buckets, water, oak, 3-hoop ......do....	5.75	6.00	5.50	....
Bath-brick ......do....	1.40	1.37½	1.25	....
Brushes, stove ......do....	4.50	4.25	4.00	....
Brushes, scrubbing ......do....	4.50	4.25	4.00	....
Brushes, dust, long-handled ......do....	7.75	8.00	7.50	....
Barley, pearl ......per pound..	.05	.05½	.05	....
Bluing, laundry, pint bottles ......per dozen..	3.00	2.75	2.50	....
Beans, string ......per pound..	.07	.08	.06	....
Blacking, stove ......do....	.40	.35	.30	....
Beets ......do....	.02½	.03	.02½	....
Cranberries ......per gallon..	.75	.80	.75	....
Carrots ......per pound..	.02½	.03	.02½	....
Cabbage, large heads ......per dozen..	1.10	1.00	.90	....
Corn, sweet-ears ......number..	2.15	2.25	2.00	....
Chocolate, Baker's ......per pound..	.35	.33	.30	....
Corn-meal, yellow, bolted ......per 100 pounds..	3.15	3.10	3.00	....
Coffee, prime Rio, whole, roasted ......per pound..	.33	.35	.30	....
Corn, canned, 2-pound tins ......per dozen..	1.80	1.80	1.75	....
Clothes-pins ......per gross..	.50	.50	.50	....
Candles, adamantine ......per pound..	.15½	.15½	.15	....
Crackers, water ......do....	.10	.03½	.03	....
Farina ......do....	.05½	.07	.06½	....
Flour, best quality ......do....	.03½	.03½	.03	....
Fish, salt ......do....	.07½	.08	.07	....
Greens ......per bushel..	1.15	1.25	1.00	....
Gelatine, 2-ounce packages ......per dozen..	1.95	1.80	1.75	....
Hominy ......per pound..	.05	.04½	.04	....
Hams, prime, sugar-cured ......do....	.16½	.16½	.16	....
Lard, prime, in tubs ......do....	.10½	.10½	.10	....
Lemon essence, 4-ounce bottles ......per dozen..	2.25	2.50	2.00	....
Lemons ......do....	.40	.35	.30	....
Lye, concentrated ......do....	1.00	1.12½	1.00	....
Macaroni ......per pound..	.10½	.11	.10	....
Mustard, Coleman's best ......do....	.62	.63	.60	....
Molasses, New Orleans, choice ......per gallon..	1.00	.80	.75	....
Matches, safety ......per gross..	2.10	2.15	2.00	....
Mackerel, No. 1 ......per barrel..	10.00	9.75	9.50	....
Onions ......per pound..	.03½	.04	.03½	....
Oatmeal ......per 100 pounds..	4.50	4.35	4.25	....
Oranges ......per dozen..	.50	.45	.40	....
Oil, sperm ......per gallon..	2.25	2.10	2.00	....
Oil, salad, 8-ounce bottles ......per bottle..	.65	.68	.60	....
Oil, Pratt's astral ......per gallon..	.31	.31½	.30	....
Parsnips ......per pound..	.03	.02½	.02½	....
Peas, green ......do....	.06½	.07	.06	....

No. 12.—MARINE CORPS.

HEADQUARTERS UNITED STATES MARINE CORPS,
Washington, D. C., October 1, 1888.

SIR: I have the honor to submit my annual report of the condition of the United States Marine Corps.

On October 1, 1888, there were 1,890 enlisted men in the corps, 925 of whom were on board ships in commission and 965 doing duty at the several shore stations.

During the past year there have been 696 enlistments, 125 re-enlistments, 18 re-enlistments from the Army, 12 deaths, 390 discharges, 419 desertions, and 6 enlisted men have been retired. One lieutenant-colonel has been retired for age and 1 first lieutenant for disability, and 1 captain on the retired list has died during the past year. Except the consequent promotions, there have been no other changes of officers.

I renew my recommendations of last year as to an increase of the higher grades and a better distribution of rank; also for an increase of second lieutenants and 500 additional privates, as urgently needed.

In consequence of the *Antietam* being no longer available, a temporary barracks has been erected at League Island until an appropriation for a proper building can be procured.

Congress appropriated during the present session $30,000 "towards the erection of a barracks at Norfolk, Va." The estimate for barracks and quarters was for $60,000. It is not believed that the sum appropriated is sufficient for the erection of a suitable building, and an estimate for $15,000 more has been submitted, on the understanding that it would be allowed. The matter of construction has been referred for other reasons to the Department.

The quarterly inspections of the different posts during the past year show them to be in a satisfactory condition.

Apprehending danger from yellow fever, now so prevalent at the South, the detachment serving at the navy-yard, Pensacola, was withdrawn and sent to Norfolk, Va., where it now is.

Recruiting has been carried on with some difficulty, but at present the corps is nearer its allowed strength than it has been for some time past.

With the completion of the new vessels now building, larger and more numerous guards will be required, and it is hoped that the Department may see proper to press the matter of an increase of officers and men upon Congress at the next session, that if allowed they may be available for duty when the vessels are ready for sea.

The regular estimates for the support of the corps were forwarded to the Department on the 27th of September.

Very respectfully, your obedient servant,

C. G. McCAWLEY,
Colonel Commandant.

Hon. W. C. WHITNEY,
Secretary of the Navy, Washington, D. C.

HEADQUARTERS UNITED STATES MARINE CORPS,
PAYMASTER'S OFFICE,
Washington, D. C., September 25, 1888.

SIR: I respectfully submit herewith estimates for the pay of officers, non-commissioned officers, musicians, and privates of the United States Marine Corps, for the fiscal year ending June 30, 1890.

These estimates show an increase of $22,129 over the estimates presented for the present fiscal year, as follows:

Pay of officers, active list, increase	$350
Pay of officers, retired list, increase	4,575
Pay of retired enlisted men, increase	1,604
Clothing undrawn	15,000
Transportation of officers, increase	1,000
Total	22,529
Pay of civil force, decrease	400
Net increase	22,129

Respectfully,

GREEN CLAY GOODLOE,
Major and Paymaster, Marine Corps.

The COLONEL COMMANDANT.

HEADQUARTERS UNITED STATES MARINE CORPS,
QUARTERMASTER'S OFFICE,
Washington, D. C., September 27, 1888.

SIR: I respectfully submit the annual estimates for the support of the Quartermaster's Department, United States Marine Corps, fiscal year 1890, and call your attention to the following changes in amounts estimated for, as against those appropriated by Congress for the same objects, fiscal year 1889:

Provisions, increased	$1,678.20
Clothing, decreased	1,282.00
Repair of barracks, increased	1,000.00
Hire of quarters for enlisted men, decreased	320.00
Military stores, decreased	500.00

The estimate for provisions is based upon the price of rations, fiscal year 1889; an addition of five enlisted men to the retired list, and the board of recruiting parties, which latter item having theretofore been paid out of amount appropriated for "transportation and recruiting."

The cost of erecting a barracks and officers' quarters at the navy-yard, Norfolk, Va., as submitted in last year's estimates, was $60,000, but Congress appropriated only $30,000 "towards the erection of a barracks"; $15,000 additional will be required this year to complete the said building.

Very respectfully, your obedient servant,

H. B. LOWRY,
Major and Quartermaster, United States Marine Corps.

The COLONEL COMMANDANT,
United States Marine Corps, Headquarters.

HEADQUARTERS, UNITED STATES MARINE CORPS,
COMMANDANT'S OFFICE,
September 27, 1888.

Forwarded.

C. G. McCAWLEY,
Colonel Commandant, United States Marine Corps.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1890, by the Paymaster's Department, United States Marine Corps.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1889.
PAY MARINE CORPS.		
Pay of officers on the active list:		
For one colonel-commandant, one colonel, two lieutenant-colonels, one adjutant and inspector, one paymaster, one quartermaster, four majors, two assistant quartermasters, one judge advocate-general U. S. Navy, nineteen captains, thirty first lieutenants, and thirteen second lieutenants	$181,880.00	
Pay of officers on the retired list:		
For one colonel, one lieutenant colonel, one quartermaster, three majors, two assistant quartermasters, five captains, three first lieutenants, and three second lieutenants	40,995.00	
Pay of non-commissioned officers, musicians, and privates:		
For one sergeant-major, one quartermaster sergeant, one leader of the band, one drum-major, fifty first sergeants, one hundred and forty sergeants, one hundred and eighty corporals, thirty musicians, ninety-six drummers and fifers, and one thousand five hundred privates	389,100.00	
Pay of retired enlisted men:		
For one sergeant-major, one drum-major, one first sergeant, four sergeants, one first-class musician, two drummers, one fifer, and twelve privates	8,240.00	
Undrawn clothing (p. 272, sec. 1596, 1623):		
For payment of discharged soldiers for clothing undrawn (act of June 30, 1834, vol. 4, p. 713, sec. 4, 5)	35,000.00	
Transportation (acts of Mar. 2, 1817, vol. 9, p. 155, sec. 3; Aug. 5, 1854, vol. 10, p. 586, sec. 1):		
For transportation of officers traveling without troops (act of Feb. 21, 1857, vol. 11, p. 163, sec. 1)	9,000.00	
Commutation of quarters (acts of July 17, 1862, vol. 12, p. 594, sec. 2; June 30, 1864, vol. 13, p. 144, sec. 1):		
For commutation of quarters to officers on duty without troops, where there are no public quarters (act of Mar. 3, 1865, vol. 13, p. 487, sec. 1)	4,000.00	
For pay of civil force (act of July 28, 1866, vol. 14, p. 334, sec. 13):		
In the office of the colonel commandant (act of Mar 2, 1867, vol. 14, p. 422, sec. 1):		
One chief clerk (act of Mar. 2, 1867, vol. 14, p. 517, sec. 7)	1,540.80	
One messenger, at $80 94 per month (act of July 15, 1870, vol. 16, p. 330, sec. 3)	971.28	
In the office of the adjutant and inspector (act of Jan. 30, 1885, vol. 23, pp. 293, 294, sec. 1):		
One chief clerk (act of Feb. 14, 1885, vol. 23, p. 305, sec. 1)	1,540.80	
One clerk (Navy "Regulations")	1,496.52	
In the office of the paymaster (act of July 18, 1816):		
One chief clerk (act of Mar. 3, 1887, vol. 24, p. 590, sec. 1)	1,600.00	
One clerk (act of Mar. 3, 1887, vol. 24, p. 590, sec. 1)	1,496.52	
One clerk (act of Mar. 3, 1887, vol. 24, p. 590, sec. 1)	1,257.12	
In the office of the quartermaster:		
One chief clerk, $1,540.80; increase $59.20 submitted	1,600.00	
One clerk	1,496.52	
One clerk	1,257.12	
In the office of the assistant quartermaster, Philadelphia, Pa.:		
One clerk, $1,204 76; increase submitted, $195.24	1,400.00	
One messenger at $1.75 per diem	638.75	
In the office of the assistant quartermaster, San Francisco, Cal.:		
One clerk	1,400.00	
Total pay of civil force	17,695.43	
Grand total	686,310.43	$673,080.20

Estimates of appropriations required for the service of the fiscal year ending June 30, 18[illegible], by the Quartermaster's Department, United States Marine Corps.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 18[illegible].
RATIONS.		
For 1,000 non-commissioned officers, musicians, and privates, and for commutation of rations for 6 enlisted men detailed as clerks and messengers; also for payment of board for recruiting parties. (See Army Reg., p. 798; see note No. 1)	$62,305.50	
For amount required to be transferred to paymaster Marine Corps on account of rations to retired men, $62.31 per annum. (See note No. 2.)	1,557.75	
Total	63,863.25	$62,185.[illegible]
NOTE 1. The commutation in lieu of rations in kind at rate of $1 and 75 cents to these enlisted men, also commutation of quarters of $21 and $10 per month, authorized by orders of the Navy Department, dated June 28, 1880, and July 30, 1885.		
NOTE 2. There are 25 retired men at this date.		
CLOTHING.		
For 2,000 non-commissioned officers, musicians, and privates	60,000.00	65,000.00
For pay of persons employed in the clothing bureaus at assistant quartermasters' offices in Philadelphia and San Francisco, as follows: One packer and one baler, at $3 each per day; three laborers, at $2 each per day for 309 days each	3,708.00	
FUEL.		
For heating barracks and quarters, for ranges and stoves for cooking, fuel for enlisted men, and sales to officers	18,000.00	18,000.00
MILITARY STORES.		
For pay of chief armorer, at $3 per day, $939; three mechanics, at $2.50 per day each, $2,347.50, in all	3,286.50	
For purchase of military equipments, such as cartridge-boxes, bayonet-scabbards, haversacks, blanket-bags, knapsacks, canteens, musket-slings, swords, drums, trumpets, flags, waist-belts, waist-plates, cartridge-belts, and spare parts for repairing muskets, etc	6,500.00	
For purchase of ammunition	1,000.00	
For purchase and repair of instruments for band, purchase of music and musical accessories	500.00	
Total	11,286.50	10,78[illegible]
TRANSPORTATION AND RECRUITING.		
For transportation of troops, and for the recruiting service	10,000.00	10,000.00
REPAIR OF BARRACKS.		
At Portsmouth, N. H.; Boston, Mass.; Brooklyn, N. Y.; League Island, Pa.; Annapolis, Md.; headquarters and navy-yard, Washington, D. C.; Norfolk, Va.; Pensacola, Fla., and Mare Island, Cal.; and per diem to enlisted men under the direction of the Quartermaster's Department in the repair of barracks and other public buildings	10,000.00	
For alteration and repair of marine barracks at Boston, Mass	5,000.00	
For rent of buildings used for manufacture of clothing, storing supplies, and offices of assistant quartermasters, Philadelphia, Pa., and San Francisco, Cal	1,780.00	
Total	16,780.00	10,780.00
ERECTION OF BARRACKS.		
At Norfolk, Va., to complete the erection of the barracks	15,000.00	30,000.00
FORAGE.		
For forage in kind for four horses of the Quartermaster's Department, and the authorized number of officers' horses	3,500.00	3,500.00

Estimates of appropriations required for the service of the fiscal year, etc.—Continued.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1889.
HIRE OF QUARTERS.		
For hire of quarters for officers serving with troops where there are no public quarters belonging to the Government, and where there are not sufficient quarters possessed by the United States to accommodate them	$4,500.00	....
For hire of quarters for six enlisted men employed, five as clerks and one as messenger in commandant's, adjutant's, and inspector's, and quartermaster's offices, Washington, D. C., and assistant quartermasters' offices, Philadelphia, Pa., and San Francisco, Cal.; five at $21 per month, each, and one at $10 per month	1,380.00	....
Total	5,880.00	$6,200.00
CONTINGENCIES.		
For freight, ferriage, toll, cartage, funeral expenses of marines, stationery, telegraphing, rent of telephone, purchase and repair of type-writers, apprehension of deserters, per diem to enlisted men employed on constant labor for a period of not less than ten days, repair of gas and water fixtures, office and barracks furniture, mess utensils for enlisted men, such as bowls, plates, spoons, knives, forks, packing boxes, wrapping-paper, oil-cloth, crash, rope, twine, camphor and carbolized paper, carpenter's tools, tools for police purposes, iron safe, purchase and repair of public wagons, purchase and repair of harness, purchase of public horses, service of veterinary surgeons, and medicine for public horses, purchase and repair of hose, repair of fire extinguishers, purchase of fire-hand grenades, purchase and repair of carts and wheelbarrows, purchase and repair of cooking stoves, ranges, stoves (where there are no grates), purchase of ice, towels and soap for offices, postage-stamps for foreign postage, purchase of newspapers and periodicals, improving parade grounds, repair of pumps and wharves, laying drain and water pipes, introducing gas, and for gas and oil for marine barracks maintained at the various navy yards and stations, water at the marine barracks, Boston, Mass., Brooklyn, N. Y., Annapolis, Md., and Mare Island, Cal.; also straw for bedding and purchase of mattresses for enlisted men at the various posts, furniture for Government houses and repair of same, and for all emergencies and extraordinary expenses arising at home and abroad, but impossible to anticipate or classify	27,500.00	26,322.02
Total	235,5[illegible]7.75	242,773.57

H. B. LOWRY,
Major and Quartermaster, U. S. Marine Corps.

QUARTERMASTER'S DEPARTMENT, U. S. MARINE CORPS,
Washington, D. C., September 27, 1888.

HEADQUARTERS U. S. MARINE CORPS,
QUARTERMASTER'S OFFICE,
Washington, D. C., September 17, 1888.

SIR: I herewith inclose abstracts, in duplicate, of proposals for furnishing rations, fuel, and supplies to the United States Marine Corps, during the fiscal year ending June 30, 1889.

Very respectfully, your obedient servant,

H. B. LOWRY,
Major and Quartermaster, U. S. Marine Corps.

Hon. W. C. WHITNEY,
Secretary of the Navy.

HEADQUARTERS U. S. MARINE CORPS,
COMMANDANT'S OFFICE,
September 17, 1888.

Forwarded.

C. G. MCCAWLEY,
Colonel Commandant, U. S. Marine Corps.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1890, by the Quartermaster's Department, United States Marine Corps.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1889.
RATIONS.		
For 1,000 non-commissioned officers, musicians, and privates, and for commutation of rations for 6 enlisted men detailed as clerks and messengers; also for payment of board for recruiting parties. (See Army Reg., p. 798; see note No. 1)	$62,305.50	
For amount required to be transferred to paymaster Marine Corps on account of rations to retired men, $62.31 per annum. (See note No. 2.)	1,557.75	
Total	63,863.25	$62,185.05
NOTE 1. The commutation in lieu of rations in kind at rate of $1 and 75 cents to these enlisted men, also commutation of quarters of $21 and $10 per month, authorized by orders of the Navy Department, dated June 28, 1880, and July 30, 1885.		
NOTE 2. There are 25 retired men at this date.		
CLOTHING.		
For 2,000 non-commissioned officers, musicians, and privates	60,000.00	65,000.00
For pay of persons employed in the clothing bureaus at assistant quartermasters' offices in Philadelphia and San Francisco, as follows: One packer and one baler, at $3 each per day; three laborers, at $2 each per day for 309 days each	3,708.00	
FUEL.		
For heating barracks and quarters, for ranges and stoves for cooking, fuel for enlisted men, and sales to officers	18,000.00	18,000.00
MILITARY STORES.		
For pay of chief armorer, at $3 per day, $939; three mechanics, at $2.50 per day each, $2,347.50, in all	3,286.50	
For purchase of military equipments, such as cartridge-boxes, bayonet-scabbards, haversacks, blanket-bags, knapsacks, canteens, musket-slings, swords, drums, trumpets, flags, waist-belts, waist-plates, cartridge-belts, and spare parts for repairing muskets, etc	6,500.00	
For purchase of ammunition	1,000.00	
For purchase and repair of instruments for band, purchase of music and musical accessories	500.00	
Total	11,286.50	10,786.50
TRANSPORTATION AND RECRUITING.		
For transportation of troops, and for the recruiting service	10,000.00	10,000.00
REPAIR OF BARRACKS.		
At Portsmouth, N. H.; Boston, Mass.; Brooklyn, N. Y.; League Island, Pa.; Annapolis, Md.; headquarters and navy-yard, Washington, D. C.; Norfolk, Va.; Pensacola, Fla., and Mare Island, Cal.; and per diem to enlisted men under the direction of the Quartermaster's Department in the repair of barracks and other public buildings	10,000.00	
For alteration and repair of marine barracks at Boston, Mass	5,000.00	
For rent of buildings used for manufacture of clothing, storing supplies, and offices of assistant quartermasters, Philadelphia, Pa., and San Francisco, Cal	1,780.00	
Total	16,780.00	10,780.00
ERECTION OF BARRACKS.		
At Norfolk, Va., to complete the erection of the barracks	15,000.00	30,000.00
FORAGE.		
For forage in kind for four horses of the Quartermaster's Department, and the authorized number of officers' horses	3,500.00	3,500.00

***Estimates of appropriations required for the service of the fiscal year, etc.*—Continued.**

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1889.
HIRE OF QUARTERS.		
For hire of quarters for officers serving with troops where there are no public quarters belonging to the Government, and where there are not sufficient quarters possessed by the United States to accommodate them	$4,500.00	....
For hire of quarters for six enlisted men employed, five as clerks and one as messenger in commandant's, adjutant's, and inspector's, and quartermaster's offices, Washington, D. C., and assistant quartermasters' offices, Philadelphia, Pa., and San Francisco, Cal.; five at $21 per month, each, and one at $10 per month	1,380.00	....
Total	5,880.00	$6,200.00
CONTINGENCIES.		
For freight, ferriage, toll, cartage, funeral expenses of marines, stationery, telegraphing, rent of telephone, purchase and repair of type-writers, apprehension of deserters, per diem to enlisted men employed on constant labor for a period of not less than ten days, repair of gas and water fixtures, office and barracks furniture, mess utensils for enlisted men, such as bowls, plates, spoons, knives, forks, packing boxes, wrapping-paper, oil-cloth, crash, rope, twine, camphor and carbolized paper, carpenter's tools, tools for police purposes, iron safe, purchase and repair of public wagons, purchase and repair of harness, purchase of public horses, service of veterinary surgeons, and medicine for public horses, purchase and repair of hose, repair of fire extinguishers, purchase of fire-hand grenades, purchase and repair of carts and wheelbarrows, purchase and repair of cooking stoves, ranges, stoves (where there are no grates), purchase of ice, towels and soap for offices, postage-stamps for foreign postage, purchase of newspapers and periodicals, improving parade grounds, repair of pumps and wharves, laying drain and water pipes, introducing gas, and for gas and oil for marine barracks maintained at the various navy-yards and stations, water at the marine barracks, Boston, Mass., Brooklyn, N. Y., Annapolis, Md., and Mare Island, Cal.; also straw for bedding, and purchase of mattresses for enlisted men at the various posts, furniture for Government houses and repair of same, and for all emergencies and extraordinary expenses arising at home and abroad, but impossible to anticipate or classify	27,500.00	26,322.02
Total	235,577.75	242,773.57

H. B. LOWRY,
Major and Quartermaster, U. S. Marine Corps.

QUARTERMASTER'S DEPARTMENT, U. S. MARINE CORPS,
Washington, D. C., September 27, 1888.

HEADQUARTERS U. S. MARINE CORPS,
QUARTERMASTER'S OFFICE,
Washington, D. C., September 17, 1888.

SIR: I herewith inclose abstracts, in duplicate, of proposals for furnishing rations, fuel, and supplies to the United States Marine Corps, during the fiscal year ending June 30, 1889.

Very respectfully, your obedient servant,

H. B. LOWRY,
Major and Quartermaster, U. S. Marine Corps.

Hon. W. C. WHITNEY,
Secretary of the Navy.

HEADQUARTERS U. S. MARINE CORPS,
COMMANDANT'S OFFICE.
September 17, 1888.

Forwarded.

C. G. MCCAWLEY,
Colonel Commandant, U. S. Marine Corps.

HEADQUARTERS MARINE CORPS,
QUARTERMASTER'S OFFICE,
Washington, D. C., July 22, 1888.

Schedule of proposals received for supplies for the Marine Corps, under advertisement inviting proposals dated March 19, 1888.

Name.	Classes.	Amount.	Name.	Classes.	Amount.
Henry C. Harper	1, 2, 3	*$6, 191. 17	William McKnight	1	$8, 850. 00
George E. Keith	1	7, 410. 00	Charles F. Bush	1	*3, 498. 50
Paul I. Field	4	*579. 65	B. Y. Pippey & Co.	1	29, 226. 50
Ridabock & Co.	1, 2	*2, 364. 85	Francis H. Smith	1	22, 330. 00
Jacob Roedel	1	*7, 260. 00	E. L. Sloan	1	3, 888. 00
San Francisco Pioneer Co.	1	*24, 700. 00	Horstman Bros. & Co	1, 2, 3, 4	*7, 572. 38
R. Wurlitzer & Bro	2	*520. 30	Lyon Bros	1	*1, 752. 00
Liberty Woolen Mills	1	*8, 490. 00	Augustus Thomas	1	9, 408. 00
T. A. Ashburner	1	*2, 604. 40	Rowland & Robbins	1, 2, 3, 4	*22, 173. 45
E. J. Griffith & Co	4	*538. 51	Charles F. Lehman	1	792. 95
John Welsh	1, 2	*1, 445. 71	John Early	1, 4	*1, 080. 13
Henry T. Kent	1	3, 240. 06	James R. Michael	1, 3, 4	4, 549. 66
Thomas G. Hood	1, 2, 3, 4	*8, 921. 44	Edward Eicke	2	†58. 50
B. Rich & Son	1	*2, 126. 75	J. Freeman & Co	1	8, 190. 00

* Accepted for part of class. † Informal.

Schedule of proposals received for supply of rations for the Marine Corps, for the year 1888, under advertisement from the Quartermaster's Office, dated March 19, 1888.

No.	Names of contractors.	At Portsmouth, N. H.	At Charlestown, Mass.	At Brooklyn, N. Y.	At Philadelphia, Pa.	At Washington, D. C.	At Gosport, Va.	At Annapolis, Md.	At Pensacola, Fla.	At Mare Island, Cal.
1	James Brownlie									$17. 40
*2	McKenzie, Oerting & Co								$23. 74	
3	S. B. Sterle									19. 49
*4	J. C. Ergood & Co	$21. 24	$18. 88			$20. 22		$19. 00		
5	J. B. Bryan					†16. 49				
6	Jos. T. Parker & Bro						†$13. 00			
*7	Horace P. Stevens		14. 25							
8	John Kealy							†16. 84		
9	John C. Gilbert		16. 95	$15. 38						
10	Levi W. Norton	†17. 24								
11	Samuel Kimberly				†18. 40		14. 23			
12	John Mullett		14. 48							
13	Charles S. Hemlett			†15. 00						
14	Thomas L. Barbour						14. 20			
15	M. L. Kelly									†16. 99
16	M. L. Doran		†13. 87							
17	Charles A. Simmons		13. 88							
18	R. A. Robbins			15. 17						
19	Frank Hame				16. 52	20. 74		16. 52*		
20	Hugh McHatton								26. 00*	
21	Jas. L. Barbour & Son					21. 25	20. 00	20. 00		

* Informal. † Accepted.

QUARTERMASTER'S OFFICE, U. S. MARINE CORPS,
Washington, May 3, 1888.

Schedule of proposals received for supply of wood and coal to the Marine Corps, under advertisement from quartermaster's office, dated March 19, 1888.

Number.	Names of bidders.	Where to be delivered.	Wood, per cord. Oak, in stick.	Oak, sawed and split.	Pine, in stick.	Pine (kindling), sawed and split.	Coal, per ton. Red ash (egg).	Red ash (stove).	White ash (egg).	White ash (stove).	White ash (furnace).
1	John Miller	Officers and officers' quarters, Washington and Georgetown, D. C., and within 1 mile of limits of said cities.	*4.00	6.50	*3.00	6.00	5.50	6.50	5.50	6.00	6.00
8	Z. Williams & Son	do	*4.58	*5.68	3.75	*4.99	*5.50	*5.75	*5.10	*5.35	*5.10
10	V. B. Johnson	do	6.00	7.00	5.00	6.50	6.50	6.75	6.25	6.50	6.25
1	John Miller	Marine Barracks and navy-yard, Washington, D. C.	5.20			5.00			5.40		5.40
8	Z. Williams & Son	do	*4.58			*3.75			*5.10		*5.10
10	V. B. Johnson	do	5.50			5.60			5.75		5.75
13	J. J. Convery	Officers and officers' quarters and rendezvous, Philadelphia, Pa.	7.45	*8.45	*7.45	*8.45		*5.00	*5.15		
5	John Kealy	Marine Barracks, Annapolis, Md.	*4.65	*6.25	*3.65	5.90	*6.20	*5.35	*5.35		*4.90
2	W. G. Parker	Officers' quarters, Norfolk, Va.	4.00	*6.50	*4.00			5.75			
14	Niemeyer & Co	do	4.98	6.75	4.98			5.97	5.97		
2	W. G. Parker	Marine Barracks, Norfolk, Va.	4.00		*4.00			*5.75	6.00		
14	Niemeyer & Co	do	4.25		4.25			5.97	*5.97		
7	S. G. French	Marine Barracks, Portsmouth, N. H.						*8.24			*8.24
12	W. H. Sise	do						12.50			12.50
15	C. C. Spinney	do	*7.60	*9.60	*6.60	*8.60					
7	S. G. French	Marine Barracks, Charlestown, Mass.						7.94			
9	G. H. Keyes	do	*9.00	*11.50	8.00	*10.50		8.50			
1	John Miller	Marine Barracks, Brooklyn, N. Y.						6.00			6.00
7	S. G. French	do	[illegible]	*9.84	*11.44	11.84		*5.84			*5.84
13	J. J. Convery	League Island						8.85			
11	W. D. Bruns, jr	Marine Barracks, League Island, Pa.	9.94	9.94	11.94	11.94		5.94			
3	Wm. Walker	Marine Barracks, Mare Island, Cal.	9.94	*9.94	9.94	12.00			19.94		
4	Aden Brothers	do	8.95	11.00	8.95	11.00			18.25		
6	Jas. McCudden	do	9.00	11.25	9.00	11.25			17.65		
7	S. G. French	do	9.00	11.25	9.00	11.25			21.75		
3	Wm. Walker	Assistant quartermaster's office.		*9.94					18.00		
4	Aden Brothers	do		11.[illegible]		20.00			[illegible]		
6	Jas. McCudden	do		[illegible]	*9.9[illegible]				*16.50		

* Accepted.

No. 13. SALES OF GOVERNMENT PROPERTY.

Statement of deposits on account of sales of Government property, Navy Department, from November 1, 1887, to November 1, 1888.

[Compiled in the Fourth Auditor's Office, by direction of the Secretary of the Treasury.]

Date of deposit.	Place of deposit.	By whom deposited.	Nature of property sold.	Amount covered to miscellaneous receipts.	Amount covered to the appropriations.	Total amount deposited.	Remarks.
1887. Nov. 9	United States Treasury	A. D. Bache, paymaster	Marine clothing	$10.85		$10.85	
8	do	H. T. Wright, paymaster	Scrap-iron, ordnance material, act March 3, 1875.		$1,808.23	1,808.23	Bureau of Ordnance.
9	do	A. K. Michler, passed assistant paymaster.	Gain on exchange	72.26		72.26	
11	do	H. B. Lowry, quartermaster, U. S. Marine Corps.	Condemned clothing	28.33		28.33	
18	do	J. Macmahon, paymaster	Gain on exchange	279.86		279.86	
18	do	J. B. Redfield, paymaster	do	453.31		453.31	
18	do	J. E. Tolfree, paymaster	Gain on exchange and condemned provisions.	2,389.48		2,389.48	Gain on exchange, $2,370.66; provisions, $18.82.
25	New York	A. Burtis, paymaster	Sale of United States steamer *Tennessee*, act March 3, 1883.	26,501.88		26,501.88	
23	The First National Bank, Newport, R. I.	F. H. Clark, passed assistant paymaster.	Ordnance material, act March 3, 1875.		25.76	25.76	Bureau of Ordnance.
29	United States Treasury	H. A. Gill, disbursing agent, U. S. Fish Commission.	84 pounds cast-iron for *Albatross*.		1.38	1.38	Bureau of Equipment and Recruiting.
29	The Norfolk National Bank, Norfolk, Va.	G. E. Hendee, paymaster	Invoice of clothing furnished revenue steamer *Walter Forward*.		140.84	140.84	Bureau of Provisions and Clothing.
Dec. 7	United States Treasury	C. P. Thompson, paymaster	Gain on exchange	36.14		36.14	
7	do	E. B. Rogers, passed assistant paymaster.	Gain on exchange and rent of Government lots.	515.04		515.04	Gain on exchange, $315.25; rent of lots, $199.79.
7	do	John Furey, paymaster	Gain on exchange	5.70		5.70	
7	do	H. B. Lowry, quartermaster, U. S. Marine Corps.	Condemned clothing	15.90		15.90	
21	do	H. A. Gill, disbursing agent, U. S. Fish Commission.	Two iron boat-davits		1.15	1.15	Bureau of Construction and Repair.
23	do	H. B. Lowry quartermaster, U. S. Marine Corps.	Proceeds of clippings	195.24		195.24	
23	The First National Bank, Newport, R. I.	George W. Simpson, assistant paymaster.	Provisions furnished officers' messes.		221.15	221.15	Bureau of Provisions and Clothing.
29	New York	J. H. Stevenson, pay inspector	Clothing sold to officers		68.10	68.10	Do.
20	United States Treasury	G. A. Bartlett, disbursing clerk.	Material furnished U. S. Coast and Geodetic Survey.		3,015.68	3,015.68	Bureau of Construction and Repair, $233.97; Steam Engineering, $3,681.71.

1888. Jan. 3	......do	M. Sicard, chief Bureau Ordnance.	Machining a tube for a 6-inch gun for Midvale Steel Co.	....	302.66	302.66	Bureau of Ordnance.
7	......do	H. R. Smith, passed assistant paymaster.	Gain on exchange	52.81	....	52.81	
7	......do	R. W. Allen, paymaster	......do	1,594.50	....	1,594.50	
7	New York	A. Burtis, paymaster	Condemned stores	613.22	....	613.22	Bureau of Construction and Repair.
13	United States Treasury	Brown, Shipley & Co., London agents.	Interest on daily balance, third quarter 1887.	1,862.00	....	1,862.00	
13	......do	S. Rand, paymaster	Gain on exchange	355.92	....	355.92	
13	......do	J. B. Redfield, paymaster	......do	366.94	....	366.94	
17	New York	A. Burtis, paymaster	Ordnance material, act March 3, 1875.	....	10,341.37	10,341.37	Bureau of Ordnance.
17	......do	......do	Sale of small-arms, act June 20, 1878.	....	1,961.55	1,961.55	Do.
19	Boston	J. F. Tarbell, paymaster	Ordnance material, act March 3, 1875.	....	17,000.00	17,000.00	Do.
17	The First National Bank, Portsmouth, N. H.	G. A. Lyon, paymaster	......do	....	10,500.00	10,500.00	Do.
17	......do	......do	Sale of small-arms, act June 20, 1878.	....	208.52	208.52	Do.
20	United States Treasury	H. B. Lowry, quartermaster, U. S. Marine Corps.	Fuel furnished officers	....	837.14	837.14	
13	San Francisco	J. Q. Burton, paymaster	Ordnance material, act March 3, 1875.	....	15,698.71	15,698.71	Do.
13	......do	......do	Sale of small-arms, act June 20, 1878.	....	238.73	238.73	Do.
13	......do	......do	Condemned clothing	....	431.10	431.10	Bureau of Provisions and Clothing.
13	......do	......do	Small stores	....	7.89	7.89	
13	......do	......do	Condemned property	8,576.94	....	8,576.94	Bureau of Construction and Repair, $2,998.36.
13	......do	......do	......do			....	Bureau of Equipment and Recruiting, $2,667.21.
13	......do	......do	......do	....	....	....	Bureau of Navigation, $335.74.
13	......do	......do	......do	....	....	....	Bureau of Steam-Engineering, $2,131.29.
13	......do	......do	......do	....	....	....	Bureau of Provisions and Clothing (provisions), $361.95.
13	......do	......do	......do	....	....	....	Bureau of Yards and Docks, $82.39.
30	New York	A. Burtis, paymaster	Rents, etc., Wallabout	1,595.25	....	1,595.25	
27	United States Treasury	G. A. Bartlett, disbursing clerk, U. S. Coast and Geodetic Survey.	Castings furnished Survey	....	30.07	30.07	Bureau of Ordnance.
Feb. 1	......do	A. J. Pritchard, pay inspector	Gain on exchange	159.15	....	159.15	
1	......do	W. J. Thomson, paymaster	......do	100.50	....	100.50	
4	The Norfolk National Bank, Norfolk, Va.	G. H. Griffing, paymaster	Clothing sold on *Franklin*	....	26.42	26.42	Bureau of Provisions and Clothing.
4	The First National Bank, Portsmouth, N. H.	G. A. Lyon, paymaster	Clothing (condemned)	....	5,417.17	5,417.17	Bureau of Provisions and Clothing.
4	......do	......do	Condemned property	58,105.35	....	58,105.35	Bureau of Provisions and Clothing, provisions $406.78.

Statement of deposits on account of sales of Government property, Navy Department, etc.—Continued.

Date of deposit.	Place of deposit.	By whom deposited.	Nature of property sold.	Amount covered to miscellaneous receipts.	Amount covered to the appropriations.	Total amount deposited.	Remarks.
1888.							
Feb. 4	The First National Bank, Portsmouth, N. H.	G. A. Lyon, paymaster	Condemned property				Bureau of Equipment and Recruiting, $12,962.82.
4	......do	......do	......do				Bureau of Steam-Engineering, $25,068.44.
4	......do	......do	......do				Bureau of Construction and Repair, $18,383.60.
4	......do	......do	......do				Bureau of Yards and Docks, $713.18.
4	......do	......do	......do				Bureau of Navigation, $541.04.
4	......do	......do	Ordnance material, act March 3, 1875.		$451.25	$451.25	Bureau of Ordnance.
4	......do	......do	Small stores (condemned)		61.56	61.56	Bureau of Provisions and Clothing.
13	New York	A. Burtis, paymaster	Small arms, act June 20, 1878		28	28	Bureau of Ordnance.
13	......do	......do	Ordnance material, act March 3, 1875.		4.35	4.35	Do.
13	......do	......do	Small stores (condemned)		430.11	430.11	Bureau of Provisions and Clothing.
13	......do	......do	Clothing		9,208.29	9,208.29	Do.
13	......do	......do	Condemned property	$6,361.41		6,361.41	Bureau of Equipment and Recruiting.
13	Philadelphia	G. Cochran, pay inspector	Rent of wharf property	200.00		200.00	Bureau of Yards and Docks.
21	The First National Bank, Newport, R. I.	F. H. Clark, passed assistant paymaster.	Ordnance material, act March 3, 1875.		798.28	798.28	Bureau of Ordnance.
21	......do	......do	Small arms, act June 20, 1878		23.42	23.42	Do.
14	United States Treasury	G. A. Bartlett, disbursing clerk, U. S. Coast and Geodetic Survey.	Coal furnished *Bache*		192.00	192.00	Bureau of Equipment and Recruiting.
Mar. 1	......do	H. A. Gill, disbursing agent, U. S. Fish Commission.	Lead-pipe, coupling brass, coal, etc.		19.40	19.49	Bureau of Construction and Repair.
2	......do	T. J. Hobbs, disbursing clerk.	Work done for Bureau of Engraving and Printing.		783.76	783.70	Bureau of Ordnance.
9	......do	George Barnett, lieutenant U. S. Marine Corps.	For flag lost		18.57	18.57	Bureau of Navigation.
5	New York	J. E. Cann, passed assistant paymaster.	Stores furnished steam-yacht *Kera*.		60.00	60.00	Bureau of Equipment and Recruiting.
14	United States Treasury	H. A. Gill, disbursing agent, U. S. Fish Commission.	Repair of dredging plant		45.64	45.64	Bureau of Yards and Docks.

	10	......do	G. A. Bartlett, disbursing clerk, U. S. Coast and Geodetic Survey.	Coal furnished *Bache*	....	264.43	264.43	Bureau of Equipment and Recruiting.
	17	......do	T. J. Hobbs, disbursing clerk.	Castings furnished Bureau of Engraving and Printing.	....	18.66	18.66	Bureau of Ordnance.
	17	......do	H. A. Gill, disbursing agent, U. S. Fish Commission.	Coal furnished *Albatross*	....	651.34	651.34	Bureau of Equipment and Recruiting.
	22	Baltimore	T. T. Caswell, pay inspector	Sale of refuse tar from gas-house.	48.60	....	48.60	Bureau of Yards and Docks.
	29	Boston	J. F. Tarbell, paymaster	Condemned clothing	....	2,450.07	2,450.07	Bureau of Provisions and Clothing.
	28	The First National Bank, Newport, R. I.	I. G. Hobbs, paymaster	Provisions furnished officers messes.	....	326.01	326.01	Do.
	21	New York	J. E. Cann, passed assistant paymaster.	Stores furnished steam yacht *Rera*.	....	48.00	48.00	Bureau of Equipment and Recruiting.
Apr.	2	United States Treasury	H. B. Lowry, quartermaster U. S. Marine Corps.	Condemned stores	34.83	....	34.83	
	3	The Norfolk National Bank, Norfolk, Va.	G. H. Griffing, paymaster	Clothing furnished Revenue Marine.	....	89.19	89.19	Bureau of Provisions and Clothing.
	7	United States Treasury	J. E. Tolfree, paymaster	Gain on exchange	1,005.90	....	1,005.90	
	7	......do	J. A. Ring, passed assistant paymaster.	......do	5.70	....	5.70	
	7	......do	Brown, Shipley & Co., London, fiscal agents.	Gain on exchange and interest on daily balance.	6,984.09	....	6,984.09	
	7	......do	J. Q. Lovell, assistant paymaster.	Gain on exchange	45.62	....	45.62	
	7	......do	A. K. Michler, passed assistant paymaster.	......do	36.22	....	36.22	
	7	......do	J. R. Stanton, passed assistant paymaster.	......do	34.14	....	34.14	
	7	......do	T. J. Cowie, assistant paymaster.	......do	49.00	....	49.00	
	7	......do	A. D. Bache, paymaster	Condemned pump	1.90	....	1.90	Bureau of Steam-Engineering.
	7	......do	O. C. Tiffany, passed assistant paymaster.	Gain on exchange	7.60	....	7.60	
	7	......do	S. Rand, paymaster	......do	219.93	....	219.93	
	7	......do	E. B. Rogers, passed assistant paymaster.	......do	86.00	....	86.00	
	7	......do	R. W. Allen, paymaster	......do	465.94	....	465.94	
	7	......do	H. B. Lowry, quartermaster, U. S. Marine Corps.	Clippings sold	96.70	....	96.70	
	16	......do	G. A. Bartlett, disbursing clerk, U. S. Coast and Geodetic Survey.	Castings furnished Survey	....	1.92	1.92	Bureau of Ordnance.
	27	The Norfolk National Bank, Norfolk, Va.	G. H. Griffing, paymaster	Clothing sold revenue steamer *Walter Forward*.	....	53.00	53.00	Bureau of Provisions and Clothing.
	26	Philadelphia	G. Cochran, pay inspector	Rent of wharf property	200.00	....	200.00	Bureau of Yards and Docks.
	27	Baltimore	T. T. Caswell, pay inspector	Proceeds of sale of text-books	9.04	....	9.04	Bureau of Navigation.
May	1	The Norfolk National Bank, Norfolk, Va.	F. H. Hinman, paymaster	Condemned oxen	64.75	....	64.75	Bureau of Yards and Docks.
	9	United States Treasury	H. B. Lowry, quartermaster, U. S. Marine Corps.	Condemned clothing	59.40	....	59.40	

Statement of deposits on account of sales of Government property, Navy Department, etc.—Continued.

Date of deposit.	Place of deposit.	By whom deposited.	Nature of property sold.	Amount covered to miscellaneous receipts.	Amount covered to the appropriations.	Total amount deposited.	Remarks.
1888.							
2[illegible]	United States Treasury	H. A. Gill, disbursing agent, U. S. Fish Commission.	Log-books and log-paper		$8.44	$8.44	Bureau of Navigation.
22	New York	A. Burtis, paymaster	Rents and privileges at Walla-bout.	$1,187.75		1,187.75	
18	United States Treasury	G. A. Bartlett, disbursing clerk, U. S. Coast and Geodetic Survey.	Salt-water soap furnished *Blake*.		13.00	13.00	Bureau of Provisions and Clothing.
18	....do	....do	Two mean-time chronometers		532.50	532.50	Bureau of Navigation.
19	....do	....do	Coal furnished *Blake*		361.20	361.20	Bureau of Equipment and Recruiting.
21	....do	....do	Sheet rubber and oil		37.27	37.27	Bureau of Steam-Engineering.
21	....do	....do	Coal, writing fluid, and cotton twine.		277.14	277.14	Bureau of Equipment and Recruiting.
June 6	....do	J. Macmahon, paymaster	Gain on exchange	37.22		37.22	
6	....do	J. B. Redfield, paymaster	....do	586.68		586.68	
6	....do	E. B. Rogers, passed assistant paymaster.	....do	86.00		86.00	
6	....do	J. Furey, paymaster	....do	20.25		20.25	
6	....do	J. E. Tolfree, paymaster	....do	1,413.72		1,413.72	
6	....do	Brown, Shipley & Co., London, fiscal agents.	Gain on exchange and interest on daily balance.	1,515.87		1,515.87	
6	....do	S. L. Heap, assistant paymaster.	Gain on exchange	48.43		48.43	
12	....do	H. B. Lowry, quartermaster, U. S. Marine Corps.	Condemned clothing	43.15		43.15	
20	Baltimore	T. T. Caswell, pay inspector	Clothing furnished general storekeeper.		113.92	113.92	Bureau of Provisions and Clothing.
23	United States Treasury	J. R. Stanton, passed assistant paymaster.	Gain on exchange and condemned provisions.	183.87		183.87	Gain on exchange, $128.34; provisions, $55.53.
23	....do	J. R. Martin, passed assistant paymaster.	Condemned biscuit	27.78		27.78	
23	....do	F. H. Arms, paymaster	Gain on exchange	217.50		217.50	
23	....do	R. W. Allen, paymaster	....do	679.66		679.66	
23	....do	A. Peterson, passed assistant paymaster.	....do	48.43		48.43	
27	The First National Bank, Newport, R. I.	I. G. Hobbs, paymaster	Provisions furnished officers' messes.		280.28	280.28	Bureau of Provisions and Clothing.
18	United States Treasury	G. A. Bartlett, disbursing clerk U. S. Coast and Geodetic Survey.	Coal furnished *Bache*		172.80	172.80	Bureau of Equipment and Recruiting.

29	......do	H. B. Lowry, quartermaster U. S. Marine Corps.	Condemned clothing	27.40		27.40	
29	Baltimore	J. P. Loomis, paymaster	Working suits and white hats		541.88	541.88	Bureau of Provisions and Clothing.
July 11	......do	do	......do		287.94	287.94	Do.
13	New York	A. Burtis, paymaster	Rents and privileges at Wallabout.	550.00		550.00	
12	New Orleans	H. E. Drury, passed assistant paymaster.	Ordnance material, act March 3, 1875.		763.06	763.06	Bureau of Ordnance.
12	......do	......do	Sale small arms, act June 20, 1878.		24.33	24.33	Do.
12	......do	......do	Condemned stores	2,609.24		2,609.24	Bureau of Equipment and Recruiting, $1,604.97.
12	......do	......do	......do				Bureau of Yards and Docks, $148.58.
12	......do	......do	......do				Bureau of Steam-Engineering, $942.22.
12	......do	......do	......do				Bureau of Medicine and Surgery, $3.47.
11	The First National Bank, Newport, R. I.	F. H. Clark, passed assistant paymaster.	Material furnished M. E. Hall		188.66	188.66	Bureau of Ordnance.
19	......do	......do	Material furnished Old Colony Steam-boat Company.		5.59	5.59	Do.
14	San Francisco	J. Q. Barton, paymaster	Condemned stores	28.00		28.00	Bureau of Provisions and Clothing.
20	Boston	C. W. Abbot, pay director	......do	25,500.00		25,500.00	Bureau of Construction and Repair, $24,000.
20	......do	......do	......do				Bureau of Equipment and Recruiting, $1,500.
20	......do	......do	Ordnance material, act March 3, 1875.		5,000.00	5,000.00	Bureau of Ordnance.
28	Philadelphia	G. Cochran, pay inspector	Rent of wharf property	200.00		200.00	Bureau of Yards and Docks.
Aug. 2	United States Treasury	H. B. Lowry, quartermaster, U. S. Marine Corps.	Fuel furnished officers		2,289.05	2,289.05	
8	......do	H. T. Wright, paymaster	Ordnance material, act March 3, 1875,		21,330.50	21,330.50	Bureau of Ordnance.
8	......do	......do	Sale small arms, act June 20, 1878.		88.56	88.56	Do.
8	......do	......do	Condemned clothing		788.50	788.50	Bureau of Provisions and Clothing.
8	......do	......do	Condemned small stores		55.33	55.33	Do.
8	......do	......do	Condemned stores	50,966.31		50,966.31	Bureau of Yards and Docks, $1,345.63.
8	......do	......do	......do				Bureau of Equipment and Recruiting, $7,874.04.
8	......do	......do	......do				Bureau of Navigation, $592.40.
8	......do	......do	......do				Bureau of Construction and Repair, $12,583.60.
8	......do	......do	......do				Bureau of Steam-Engineering, $28,549.13.
8	......do	......do	......do				Bureau of Provisions and Clothing, $21.51.

Statement of deposits on account of sales of Government property, Navy Department, etc.—Continued.

Date of deposit.		Place of deposit.	By whom deposited.	Nature of property sold.	Amount covered to miscellaneous receipts.	Amount covered to the appropriations.	Total amount deposited.	Remarks.
1888.								
Aug.	13	United States Treasury	J. C. Sullivan, passed assistant paymaster.	Gain on exchange	$8.50		$8.50	
	13	......do	Brown, Shipley & Co., London, fiscal agents.	Gain on exchange and interest on daily balance.	570.87		570.87	
	22	New York	J. P. Loomis, paymaster	Clothing and small stores furnished revenue marine steamer *Boutwell*.		$48.11	48.11	Bureau of Provisions and Clothing.
	31	United States Treasury	R. P. Lisle, paymaster	Condemned provisions	63.45		63.45	Do.
Sept.	6	......do	H. R. Smith, passed assistant paymaster.	Gain on exchange	73.57		73.57	
	6	......do	J. R. Stanton, passed assistant paymaster.	Gain on exchange	99.99		99.99	
	11	......do	T. J. Hobbs, disbursing clerk.	Material furnished Bureau of Engraving and Printing.		52.49	52.49	Bureau of Ordnance.
	11	New York	A. Burtis, paymaster	Scrap iron	.44		.44	Bureau of Construction and Repair.
	15	United States Treasury	H. B. Lowry, quartermaster, U. S. Marine Corps.	Condemned marine clothing	53.20		53.20	
	19	......do	T. K. Sailer, acting chief Bureau of Ordnance.	Repairs to police boat for District of Columbia.		277.67	277.67	Bureau of Ordnance.
	26	Philadelphia	W. J. Thomson, paymaster	U. S. S. *Antietam*, act March 3, 1883.	6,573.00		6,573.00	
	28	The First National Bank of Portsmouth, N. H.	G. A. Lyon, paymaster	Boilers and iron armor	3,966.64		3,966.64	Bureau of Steam-Engineering, $2,770.87.
	28	......do	......do	......do				Bureau of Construction and Repair, $1,195.77.
	27	The First National Bank of Newport, R. I.	I. G. Hobbs, paymaster	Provisions furnished officers' messes.		227.24	227.24	Bureau of Provisions and Clothing.
Oct.	2	New York	J. P. Loomis, paymaster	Clothing and small stores furnished revenue steamer.		15.76	15.76	Do.
	5	United States Treasury	H. B. Lowry, quartermaster, U. S. Marine Corps.	Fuel furnished officers		222.00	222.00	
	8	The First National Bank of Portsmouth, N. H.	G. A. Lyon, paymaster	One brown mare	50.00		50.00	Bureau of Yards and Docks.
	25	United States Treasury	J. B. Redfield, paymaster	Gain on exchange and sale of condemned mattresses.	411.73		411.73	Gain on exchange, $385.78; condemned mattresses, $25.95.
					217,905.08	119,190.15	337,095.23	

No. 14.—SALE OF CONDEMNED VESSELS.

SALE OF CONDEMNED VESSELS.

William C. Whitney, Secretary of the Navy, in account current with the United States for proceeds of sales of condemned vessels, under public advertisements of April 25 and August 15, 1887, and May 14 and August 6, 1888, inviting written proposals, and in pursuance of the acts of August 5, 1882, 22 Stats., p. 296, and March 3, 1883, 22 Stats., p. 599.

DEBITS.

1887.			
Oct.	31.	To balance due the United States	$17,384.87

CREDITS.

For publishing advertisement of August 15, 1887.

1888.			
Jan.	31.	To Herald, New York	3.60

For publishing advertisement of April 25, 1887.

May	1.	Examiner, San Francisco	184.60

For publishing advertisement of May 14, 1888.

June	21.	To Graphic, New York	33.60
	28.	To News, New York	24.00
July	7.	To Journal of Commerce, New York	15.20
	17.	To Eagle, Brooklyn	12.60
Aug.	30.	To Telegram, New York	16.80

For publishing advertisement of August 6, 1888.

Sept.	1.	To Sun, New York	38.40
	8.	To Times, New York	26.00
	12.	To Times, Philadelphia	21.60
Oct.	10.	To Sun, Baltimore	15.60
	11.	To Demokrat, Philadelphia	18.60
	16.	To Globe, Boston	13.00
Nov.	17.	To Record, Philadelphia	20.80
	13.	Covered into United States Treasury per certificate of deposit No. 4370 as miscellaneous receipts	16,000.00
		Balance due the United States on deposit with the Treasurer United States	910.47
			17,384.87

Certified to be correct.

JNO. W. HOGG,
Chief Clerk.

NOVEMBER 19, 1888.

No. 15.—GENERAL BERDAN'S TORPEDO SYSTEM.

(Supplement to Admiral Porter's Annual Report.)

OFFICE OF THE ADMIRAL,
Washington, D. C., November 7, 1888.

SIR: As you are aware, I have always taken an interest in every weapon that promised to add strength to the feeble force of our Navy, and in my late annual report I laid great stress on the torpedo invented by General Berdan, formerly of the U. S. Army.

I had some doubts of General Berdan's plan of placing the swinging bars carrying the torpedo in the bow of his vessel, but even with that drawback the invention was the best in existence, and was a comparatively certain method of destroying an enemy's ship by a new arrangement of the torpedo bars.

General Berdan's improved invention is graphically described in the pamphlet accompanying the drawings, and the calculations are so minute and careful that there can be no doubt of the success of this formidable weapon when used as a means of defending our coasts and harbors. There may exist in General Berdan's machine some mechanical difficulties, but these can be easily rectified.

I feel sure that General Berdan has solved the problem of destroying ships with torpedoes, by being able to strike an enemy's vessel, under all circumstances, with a heavy mine of gun-cotton directly under the bottom, rendering her *hors du combat* if not sinking her. With General Berdan's former device I think he could have inflicted serious injury on any class of vessels, but with his present invention he could do much better, in fact he might say like Archimedes, "*Eureka! Eureka!*"

When we consider the vast amount of time and money that has been spent throughout the world in the endeavor to perfect the torpedo, we can not but be impressed with the simplicity of design and certainty of working in the invention of General Berdan. Restricted as our Navy is in the means of defense, we should lose no time in discussing a machine which promises so many advantages. Here is a plan of a vessel that can explode with certainty 100 pounds of gun-cotton beneath the bottom of an iron-clad, equal to 300 pounds of the strongest gunpowder. This gun-cotton, exploded at a depth of 25 feet, will raise a column of water 6 feet in diameter and weighing upwards of 45,000 pounds. This, by mathematical computation, would give 112,525,000 foot-tons, a force sufficient to destroy the strongest built ship in existence.

One of the best features of the invention is that the torpedo-vessel and apparatus would be hermetically sealed against an enemy's shot—an indispensable requirement in a perfect torpedo-vessel. The present plans

of General Berdan provide what his former ones in a measure lacked, viz, the power to run close alongside an enemy and deliver its blow while going at full speed, while the enemy is at anchor or underway, the torpedo-vessel passing under the line of fire of such guns as could injure her.

It has been demonstrated beyond a doubt that by means of the latest improved torpedo nets, the automobile torpedos are rendered innocuous, and although great efforts will doubtless be made to guard against the attacks of the Berdan net-destroying torpedo, I see at present no method by which ships of war can guard against its attacks except by having every ship liberally supported by torpedo-boats of the same kind, ready at any moment to act against the assailant. That seems to me the solution of the problem; for heavy ships armed with heavy guns—the prime factors in war—must be protected at all hazards.

In my judgment the Berdan invention is a new departure in torpedoes, which have hitherto played an unimportant part in the history of war, have cost immense sums of money, and employed the brains of many intelligent persons in determining how best to explode a torpedo against a ship of war at the point where it would do the most harm. So far General Berdan's plan has the best of it, and I am of opinion, if sufficient means are afforded, he will produce the best torpedo and torpedo-vessel that have ever been devised. A ship may yet be built that will offer sufficient resistance to the Berdan torpedo, but she will probably prove a cumbersome affair.

No torpedo-vessel has ever yet been built properly equipped to attack and destroy at all times and in all places thoroughly built armor-clad ships of war, but this plan of General Berdan's goes far to upset my theory that heavy ships can always protect themselves against the torpedo in whatever shape it may appear. This invention is so far in advance of the automobile torpedo that I can but admit that heavy ships are about to encounter a new Samson that will sorely test their powers of endurance and the skill of their officers.

I have carefully examined all the mechanical appliances of the Berdan torpedo-vessel, the power necessary to work the engines, etc., and have gone over all the calculations, which I find to be correct—so much so that I would not hesitate to take the working plans as they stand and lay down a vessel in the belief that it would operate as well as it is claimed by the inventor.

We have so far, fortunately, not gone deeply into the torpedo business; but I think an opportunity is now presented where we can safely embark in this system of warfare with a fair prospect of putting ourselves at one *coup* on an equality with the leading naval powers of Europe, for the Berdan torpedo would be an important adjunct in naval warfare and would add greatly to our coast defense, a subject which is now creating much anxiety throughout the country.

No hostile force would approach our coasts, except with great precaution, if we were provided with, say, thirty good sea-going Berdan torpedo-boats, which, backed by a fair fleet of armor-clads, would be irresistible against the ships of war and torpedo-vessels of the present type. When I speak of the Berdan torpedo-boats, I refer to vessels that can keep the sea in all weathers and accompany a squadron, can operate in shoal as well as in deep water, have their machinery and torpedo apparatus protected against 6-inch shell at least, and have a speed of not less than 26 knots an hour. All these are matters not difficult to attain, and such torpedo-vessels grappling with heavy an-

tagonists would probably inflict such serious injury that the enemy's vessels would have all they could do to keep afloat. It might all end in a battle between torpedo-vessels, but then those best adapted to the purpose would win.

After due consideration I recommend that this matter be carefully investigated. I approved of General Berdan's last design, but this is an improvement, and if the Government will embark in the newly devised Berdan torpedo-vessel with a spirit of liberality, I am satisfied that we will have the best system of torpedoes afloat.

I have the honor to be, very respectfully, your obedient servant,

DAVID D. PORTER,
Admiral, U. S. Navy.

To the SECRETARY OF THE NAVY.

NO. 16. CENTENNIAL EXPOSITION AT CINCINNATI.

REPORT OF LIEUT. RICHARD RUSH, U. S. NAVY.

NAVY DEPARTMENT, WASHINGTON, D. C.,
November 23, 1888.

SIR: I have the honor to submit herewith my report of the participation of this Department in the Centennial Exposition of the Ohio Valley and Central States, held at Cincinnati, Ohio, from July 4 to November 8, 1888, to which exposition I was appointed the representative by your letter of instructions of the 13th of June last.

Under the authority of the act of Congress of May 28, 1888, providing for the participation of the Executive Departments of the Government in this exposition, the Navy Department had prepared, under your direction, an exhibit which was in such an advanced state of readiness, that I was enabled to transfer it to Cincinnati, and install it in the Government display by the day the exposition opened. The exhibition was formally opened on the 4th of July, in the presence of the governors of the Ohio Valley and Central States, the commissioners of the exposition, and a vast and distinguished assemblage, by an electric signal made by Mrs. James K. Polk, the widow of ex-President Polk, at Nashville, Tenn. The arrangements for carrying out this plan were by the time service of the Navy Department exhibit, through the courtesy of the Western Union Telegraph Company.

The act of May 28, 1888, contemplated the close of the exhibition on the 27th of October, but by a vote of the commissioners the time was extended until the 8th of November, a joint resolution having passed Congress authorizing the continuance of the Government display until the 15th of that month. The exhibition finally closed on November the 8th.

In the preparation of the exhibit of this Department two general objects were kept prominently in view.

The first of these was to present as far as space would permit a comprehensive representation of the work now in progress, in the construction, equipment, and armament of the new Navy. The Bureau of Construction and Repair and the Bureau of Ordnance were the contributors to this portion of the exhibit. In construction, the work in progress was graphically shown by a painting of the steel cruiser *Atlanta*, and by two half and four full models representing respectively the *Dolphin*, *Chicago*, *Newark*, *Baltimore*, *Yorktown*, and *Petrel*. These beautiful models, in themselves works of art, illustrated clearly to the visitor what the new ships will be, and attracted universal attention and admiration. Brief descriptions of the ships were attached to the models

by which the public could readily comprehend their design. The exhibit of the Bureau of Ordnance was placed next in order, so that the visitor might see at a glance the armament of the new ships. In this exhibit were displayed full-sized models of the new high-powered breech-loading rifles, and samples of the rapid-fire and machine guns; the former comprising the main, and the latter the secondary, batteries of the ships. Models of the charges and projectiles for the heavy guns, and samples of the rapid-fire and machine-gun ammunition completed this representation of the progress of new construction and armament. As an additional portion of the exhibit of the Bureau of Ordnance, there were displayed complete and selected lots of navy projectiles, navy fuses, and of small arms, and a torpedo outfit sent from the torpedo station at Newport. A number of interesting historical relics from the museum of the Washington navy-yard were also shown in this section.

The second, and perhaps not less important, general object which was followed in the preparation of the Navy Department exhibit was the illustration of the scientific work accomplished by the Navy in time of peace. This portion of the exhibit was the contribution of the Bureau of Navigation, with its subordinate offices, the Hydrographic Office and Naval Observatory, and it illustrated by instruments, photographs, and models, the processes of ocean and harbor surveys, the method of chart construction, the preparation and distribution of hydrographic information at the centers of trade and commerce, the determination of longitudes and the distribution of standard time throughout the country, from the Naval Observatory at Washington. In connection with the time service, a time ball was dropped from a tower on the exhibition buildings, and gongs were struck in machinery hall and in the park annex, daily, by electric signal from Washington, giving the correct standard time.

The exhibit of the Naval Academy and the miscellaneous exhibit contained many objects of interest, all of which are described at length in the catalogue which has been prepared and published by your direction, and copies of which have already been forwarded to the Department. Some large photographic views of the exhibit were also obtained, and will be forwarded as soon as completed.

I desire to bring to your attention the very great interest which was manifested at this exhibition in all matters relating to the Navy and the naval service, an interest which I venture to believe was largely increased by the opportunities afforded the public in that section of the country of examining the Government exhibit.

By the direction of the chief of the Bureau of Equipment and Recruiting a detail of six seamen gunners was made from the receiving ship at New York for police duty in this department. These men by their efficient performance of duty, attention to visitors, and excellent deportment have reflected credit upon the apprentice system of the Navy.

In closing this report I beg leave to bring to your notice the efficient services of Ensigns A. B. Clements and John Gibson, the two officers detailed by the Department as my assistants. To Mr. Gibson was given the immediate supervision of the packing, shipment, and installation of the exhibit, and he rendered valuable assistance by his executive ability and prompt performance of duty. Mr. Clements had charge of the management of the time service, which important duty was creditably performed. I am also indebted to Mr. I. N. Miller, the manager of the Western Union Telegraph Company at Cincinnati, for valuable services rendered in connecting the exhibit with the Western

Union Lines, thus affording through telegraphic service with the Naval Observatory at Washington. I desire to express also my acknowledgments to Mr. W. F. Gardner, of the Observatory, for his skillful superintendence in the packing of delicate instruments and models.

I am, sir, very respectfully, your obedient servant,

RICHARD RUSH,
Lieutenant, U. S. Navy, Representative of the Navy Department to the Cincinnati Exposition.

The SECRETARY OF THE NAVY,
Washington, D. C.

No. 17.—DETAILED MOVEMENTS OF VESSELS, 1888.

NORTH ATLANTIC STATION.

The squadron on this station during the past year has continued under the command of Rear-Admiral Stephen B. Luce. The vessels composing it at present are the *Pensacola*, *Ossipce*, *Galena*, and *Yantic*. The *Richmond*, *Atlanta*, and *Dolphin* have been detached from the squadron and the *Pensacola* added.

PENSACOLA.

The *Pensacola* sailed from Norfolk, Va., February 29, 1888, and arrived at New York March 1. After receiving on board at this port new officers and men for the *Omaha* and the remains of the late General José Antonio Paez, first President of the Republic of Venezuela, she sailed March 24 for La Guayra, where she arrived April 7. The remains of General Paez were there landed. Leaving this port April 13 the ship proceeded to Aspinwall and arrived there April 23, having touched at Curaçao en route. Officers and men were here exchanged for those on board the *Omaha*, and she sailed for New York April 29, where she arrived May 13. Sailed for Norfolk for repairs August 1 and reached that port three days later.

OSSIPEE.

The *Ossipce* left Newport November 28, 1887, for target practice in Gardiner's Bay and sailed thence two days later for Norfork to prepare for the winter cruise in the West Indies. She arrived at Norfolk December 2. She remained in that port until the 19th of January, 1888, when she sailed for St. Thomas, where she arrived on the 28th of the month. Sailed February 5 and, touching at Frederickstod, St. Kitt's, Prince Rupert's Bay, and St. Lucia, arrived at Bridgetown February 16. Left on the 28th for Port au Prince and arrived the next day. She remained at Port au Prince until March 9, then visited Curaçao, Aspinwall, Greytown, and arrived at Key West March 28. Sailed thence for Pensacola April 6 and arrived there two days later. Left April 28 and arrived at Mobile the same day. After a visit of five days to this port, proceeded to New Orleans and thence to Pensacola, where she arrived May 13. Sailed the next day and arrived at Port Royal May 19. Left on the 28th, touched at Lynn Haven Bay three days later, and thence proceeded to Annapolis, arriving June 2. Sailed June 15, stopped at Norfolk and Hampton Roads, and left the latter place for New York June 25 and arrived there on the 27th. Sailed July 3 and arrived at New London July 5. Left on the 15th and, after touching at Greenport, returned to New London July 17; thence pro-

ceeded to Newport, where she arrived July 18. Left on the 23d, visited Portsmouth, and returned to Newport August 2. She left this place August 10 for a cruise to the fishing grounds in and about the Gulf of St. Lawrence; arrived at Halifax August 13; left on the 16th, visited Hawksbury and Souris, returning to Halifax on the 23d. She remained in this port until the 28th, when she left for Portland, Me., and reached there on the 30th. Left on the same day and arrived at Newport August 31. Sailed for New York September 4 and reached that port on the 5th. Left on the 22d and arrived at League Island two days later. Took the monitor *Puritan* in tow October 5 for Norfolk and arrived there on the 15th. She is now at the Norfolk yard preparing for a cruise to the West Indies.

GALENA.

The *Galena* sailed from Newport November 28, 1887, for target practice in Gardiner's Bay and thence two days later for New York, where she arrived December 1. Sailed December 12 and arrived at the navy-yard, Norfolk, Va., on the 14th. After undergoing repairs at that yard she sailed April 9 to join the squadron at Pensacola, touched at Key West, and arrived at Pensacola April 18, from which port she sailed on the 28th for Mobile and arrived there the same day. Thence proceeded to New Orleans and, after remaining in that port one week, left for Port Royal, where she arrived May 19, having touched at Pensacola for coal. She left Port Royal May 26, touched at Hampton Roads, Va., two days later, and arrived at Annapolis June 1. After a visit of two weeks she proceeded to Norfolk, thence to Hampton Roads and New York, and arrived at the latter place June 27. She left New York July 2, touched at Fort Schuyler and Fisher's Island, and reached New London on the 4th. Sailed July 10 for New Haven and arrived there the same day; left two days later, anchored in Flushing Bay, and returned to New York July 13. Sailed on the 14th and returned to New London the next day. Proceeding thence on the 18th arrived at Newport the same day. She remained at Newport until the 24th, when she left for Boston, where she arrived July 27, and after a visit of three days again returned to Newport. Sailed for Port au Prince August 18, and having touched at Norfolk for coal and provisions, arrived August 31. Sailed September 5 for Port Royal, Jamaica, and thence on the 7th for New York, where she arrived September 15.

YANTIC.

The *Yantic*, having completed her repairs, sailed from Norfolk, Va., for the West Indies January 5, 1888, and arrived at Barbadoes January 16. Thence she proceeded to Port au Prince, La Guayra, Curaçao, Aspinwall, and Havana, and arrived at Key West March 22. Sailed April 4 and arrived at Pensacola on the 7th. She remained at Pensacola until April 28th, when she sailed, and after visiting Mobile, New Orleans, and Key West, arrived at Port Royal, S. C., May 20. Sailed for Port au Prince May 28, and arrived there June 1. She remained at Port au Prince until the 7th, when she sailed for Hampton Roads, Va., where she arrived June 18, having touched at Santiago de Cuba en route. Left June 25 for New York and arrived there on the 27th. She left this port August 3 for Newport, where she arrived on the 5th. Thence proceeded, August 22, on a cruise to the fishing banks, touched at Boston and Portland, and arrived at Halifax September 2. Sailed for New York September 16 and reached that port on the 21st.

RICHMOND.

The *Richmond* left Newport, R. I., November 14, 1887, and arrived at New York the next day, where she remained until November 23, when she returned to Newport. Accompanied by the other vessels of the squadron, she left that port on the 28th of November for target practice in Gardiner's Bay, where she remained until the 30th, when she proceeded to New York to prepare for the winter cruise. She sailed from New York for the West Indies January 21, 1888, and arrived at St. Thomas on the 30th. After remaining in that port one week she sailed for St. Kitts, where she arrived February 7. Leaving the same day she visited Point-à-Pitre, Bridgetown, Pitch Lake, and Port of Spain, reaching the latter place February 19. She remained in that port until February 24, and then proceeded to La Guayra, where she arrived on the 26th. Left March 1, and after visiting Curaçoa, Cartagena, and Aspinwall arrived at Key West March 28. Sailed for Pensacola April 6, for squadron drills and exercises, ashore and afloat, and arrived at that place on the 9th. Proceeded thence April 30, visited Mobile, New Orleans, and Key West, and arrived at Port Royal, S. C., May 19, where the vessels of the squadron assembled for drills and maneuvers. Leaving Port Royal May 28, she arrived at Hampton Roads on the 31st, and thence proceeded to Annapolis, reaching that port June 2. After a stay of two weeks she left for New York, where she arrived June 27, having stopped at Hampton Roads en route. She is now at the New York yard preparing for service.

ATLANTA.

The *Atlanta* sailed from Newport November 28, 1887, for target practice in Gardiner's Bay, after which she proceeded to New York, where she arrived December 1. She remained in this port until February 13, 1888, when she sailed for the West Indies, visited Port au Prince, San Domingo, St. Thomas, and Aspinwall, and sailed from the latter place April 2, for Pensacola, at which port she arrived on the 10th of that month. Left April 30, and after visiting Mobile, New Orleans, and Havana, arrived at Port Royal May 19. She remained at this port until May 26, when she sailed for Lynn Haven Bay, where she arrived two days later. Thence proceeded to Annapolis, and after remaining in that port two weeks left for Norfolk, at which port she arrived June 16. She received here coal and supplies, sailed on the 19th, anchored the same day in Hampton Roads, and left that place for New York June 25, and arrived on the 27th. Sailed July 2 for Bridgeport, and after a visit of five days again returned to New York. She is now at the navy-yard at that place, preparing for service on a foreign station.

DOLPHIN.

The *Dolphin* sailed from Newport November 28, 1887, for target practice in Gardiner's Bay, and arrived at New York December 1, where she remained until January 21, 1888, when she sailed for a cruise to the West Indies. She arrived at Key West January 26, and left on the 29th for Havana, arriving at that port on the 30th. She sailed the next day and arrived at Cienfuegos February 2, when she was detached from the squadron and ordered to the Pacific Station.

SOUTH ATLANTIC STATION.

The force on this station is now under the command of Acting Rear-Admiral James H. Gillis, who relieved Rear-Admiral Daniel L. Braine at Rio de Janeiro on the 23d of October last, and consists of the *Tallapoosa*, *Alliance*, and *Swatara*. The *Lancaster* has been detached from the squadron and the *Swatara* added.

TALLAPOOSA.

The *Tallapoosa* sailed from Maldonado December 15, 1887, and arrived at Montevideo the same day. She remained in this port until June 11, 1888, when she sailed for Colonia, where she arrived the next day. Proceeding thence on the 14th she visited Nueva Palmyra, Fray Bentos, Paysander, and Conception, returning to Nueva Palmyra June 29. Sailed the following day and arrived at Rosario July 2. She remained at this port until July 15, when she sailed for Parana, where she arrived the next day. Left July 20 and arrived at Rosario July 30. Sailed August 23, and after visiting the cities of San Nicholas and San Pedro, on the Parana River, arrived at Colonia August 28. Left September 9 and arrived at Buenos Ayres the same day, which port she left on the 10th and arrived the day after at Montevideo.

ALLIANCE.

The *Alliance* sailed from Santa Catharina November 12, 1887, and arrived at Maldonado on the 17th of that month, where she remained until the 15th of December, when she left for Montevideo, arriving at that port the same day. She sailed January 19, 1888, for Ensenada, and after an absence of seven days again returned to Montevideo. She left this port June 9 for Punta Arenas, where she arrived June 23. Sailed July 24 and arrived at Montevideo August 8. Left August 30, visited Colonia and Buenos Ayres, and arrived at Montevideo September 11.

SWATARA.

The *Swatara* sailed from New York August 18, 1888, to join the South Atlantic Squadron. She arrived at St. Vincent, Cape de Verde Islands, September 11, and sailing thence on the 15th arrived at Rio de Janeiro, Brazil, October 6, and at Maldonado November 22.

LANCASTER.

The *Lancaster* arrived at Maldonado November 20, 1887, where she remained until the 15th of December following, when she sailed for Monte Video, at which port she arrived the same day. She was detached from the South Atlantic Squadron January 18, 1888, and sailed that day for the European Station.

PACIFIC STATION.

The Pacific Squadron continues under the command of Rear-Admiral L. A. Kimberly, and consists of the *Trenton*, *Vandalia*, *Mohican*, *Adams*, *Alert*, *Nipsic*, *Dolphin*, *Pinta*, and store-ship *Monongahela*. The *Iroquois* and *Juniata* have been detached from the squadron during the year, and the *Trenton*, *Nipsic*, and *Dolphin* have been added to it.

TRENTON.

The *Trenton* sailed from New York for the Pacific station January 30, 1888, and arrived at Monte Video March 20, having touched at St. Vincent, Cape de Verde Islands, en route. She remained at Monte Video until April 11, when she sailed for Callao, where she arrived May 17. Sailed November 20, and arrived at Payta, Peru, on the 23d of that month.

VANDALIA.

The *Vandalia* left Honolulu March 11, 1888, visited Hilo, and returned to Honolulu, arriving at the latter place March 25; sailed for San Francisco September 19, and arrived there October 9; reached the Mare Island yard two days later.

MOHICAN.

The *Mohican* sailed from Honolulu for the Samoan Islands January 11, 1888, and arrived at Apia on the 28th of that month. She left that port on the 31st and proceeded to Pango Pango, where she arrived the next day; left February 9 and returned to Apia the next day. She remained in this port until April 29, when she sailed and visited Mail Sloop Bank, Tangaloa Bay, and Pango Pango, and returned to Apia March 25. Left June 3, and arrived at Honolulu on the 30th of that month, where she remained until July 9, when she sailed for San Francisco. She arrived at that port August 1, and reached the navy-yard, Mare Island, on the 4th.

ADAMS.

The *Adams* arrived at Apia October 19, 1887, and sailing thence November 25 reached the Tonga Group on the 29th. After a visit of a few days she returned to Apia, arriving December 6. She sailed January 30, 1888, for Honolulu, where she arrived February 29. She remained in this port until May 14 when she again sailed for Apia and arrived there on the 31st of that month. Sailed July 21; visited the Tonga Group and returned to Apia, arriving August 6. She is now under orders to proceed to San Francisco when relieved by the *Nipsic*.

ALERT.

The *Alert* left Callao January 14, 1888, and arrived at Panama on the 28th of that month, where she remained until the 20th of February, when she sailed for Callao, where she arrived March 5, having touched at Payta en route. She left Callao March 22 and arrived at Ancon the same day. She remained there until April 6 when she returned to Callao, arriving the same day. Sailed for Honolulu August 11, and arrived at that port September 15.

NIPSIC.

The *Nipsic* was put in commission at the navy-yard, New York, October 10, 1887, and sailed for the Pacific Station, January 18 following; touched at St. Vincent, Cape de Verde Islands, Montevideo, Sandy Point, and arrived at Callao, June 30. Sailed for Samoa to relieve the *Adams* September 23; arrived at Tutuila, Samoan Group, November 7.

DOLPHIN.

The *Dolphin* sailed from Cienfuegos, February 3, 1888, for the Pacific Station, and after touching at St. Lucia, Barbadoes, Bahia, Montevideo, and passing through the Straits of Magellan, arrived at Callao March 26. She remained at this port until May 15, when she sailed for Panama, where she arrived May 21. Proceeding thence, July 2, visited the following named ports: Punta Arenas, Corinto, Amapala, La Libertad, San José de Guatemala, Acapulco, and Pichilinque, arriving at the latter place July 30. Sailed for Honolulu August 4, and arrived at that port on the 17th, where she remained until the 1st of September when she left for San Francisco. She arrived at that place September 14, and reached the Mare Island yard the same day. Sailed November 13 for a cruise down the Mexican and Central American coasts; arrived at Acapulco November 21, and at Corinto on the 26th.

IROQUOIS.

The *Iroquois* arrived at Payta November 9, 1887, and left the next day for Acapulco, at which port she arrived November 22. Then visited Mazatlan, Topolobampo Bay, Guaymas, Pichilinque, and San Diego, and arrived at San Francisco December 30, and at the Mare Island yard January 6, 1888. She sailed January 7 for Humbolt Bay in search of the derelict American schooner *John Hancock*, and returned to Mare Island January 11. She was put out of commission March 6, 1888.

JUNIATA.

The *Juniata* remained at Honolulu until December 31, 1887, on which date she was detached from the squadron and sailed for the Asiatic Station.

PINTA.

The *Pinta* has been employed throughout the year exclusively in Alaskan waters.

MONONGAHELA.

The *Monongahela* sailed from Coquimbo February 2, 1888, and arrived at Payta on the 27th of that month. Left that port March 13, arrived at San Francisco May 19, and at the Mare Island yard May 29.

ASIATIC STATION.

The force on this station remains under the command of Rear-Admiral Ralph Chandler. The vessels composing it are at present the *Omaha*, *Marion*, *Essex*, *Palos*, and *Monocacy*. The *Brooklyn* and *Juniata* have recently been detached from the squadron and ordered to the United States.

OMAHA.

The *Omaha* sailed from Chemulpo November 16, 1887, and arrived at Fusan on the 18th. Sailed again the same day and arrived at Nagasaki November 19. She remained in this port until January 6, 1888, when she left for Yokohama, where she arrived January 11, having touched at Kobe en route. Sailed January 23 for Panama for relief officers and

men, and reached that port March 23. Proceeding thence May 5, visited Punta Arenas, Corinto, Amapala, La Libertad, San José de Guatemala, and Acapulco, arriving at the latter port June 5. Sailed June 15, and arrived at Honolulu July 14. She remained at Honolulu until August 18, when she sailed for Yokohama, where she arrived September 15. Left on the 25th of that month, and arrived at Shanghai October 3, having touched at Kobe and Nagasaki en route.

MARION.

The *Marion*, after receiving new officers and men at Panama, left that port December 18, 1887, and arrived at Corinto December 22. Sailed thence December 28, and arrived at Honolulu February 13, 1888, having visited San José de Guatemala and Acapulco on the way. She remained at Honolulu until April 10, when she sailed for Yokohama, where she arrived June 1. She left this port June 6 for Yokosuka and returned to Yokohama, arriving there June 28. Left August 4, visited Kobe, and returned to Yokohama August 31. Leaving this port on September 20, she visited Hakodate and ten days later again returned to Yokohama. Sailed for Kobe October 13, and from that port October 16 for Shanghai, where she arrived October 24.

ESSEX.

The *Essex* arrived at Yokohama December 13, 1887, from the Caroline Group and left that port six days later for Kobe, where she arrived December 21. She remained in this port until the 20th of May, 1888, when she returned to Yokohama. Sailed June 4; arrived at Nagasaki on the 9th; left on the 13th, and arrived at Chemulpo June 15. Sailed again July 7; visited Vladivostock and Hakodate, and arrived at Yokohama August 4. Leaving this port August 17, and touching at Kobe, she arrived at Chemulpo August 29. Orders have recently been sent out for her return to the United States.

PALOS.

The *Palos* left Nagasaki October 10, 1887, and after touching at Gogo Lima October 11 arrived at Yokohama on the 14th, where she remained until the 25th, and then proceeded to Kobe, where she arrived two days later. She left this port November 14, visited Konova Bay, Gogo Lima, and Haidmari Bay, and arrived at Nagasaki November 19. Leaving this port November 27, she visited Guerin Island, and arrived at Chemulpo December 1. She remained in this port until June 19, 1888, when she sailed for New Chwang, where she arrived June 23. From thence she proceeded to Ninghai, Taku, Tientsin, and Chefoo, and arrived at the latter place July 13; and sailing again on the 24th, arrived at Kobe July 30. Left for Nagasaki August 26, and arrived at that port three days later. Left September 5, to assist in towing the *Brooklyn* to sea, and returned to Nagasaki on the 7th, from which port she sailed on the 13th, and arrived at Kobe September 19. Sailed for Tientsin October 11, where she will go into winter quarters.

MONOCACY.

The *Monocacy* has been in Yokohama since last report.

BROOKLYN.

The *Brooklyn* sailed from Nagasaki October 25, 1887, and after visiting O'osaka, Hirado, Fuknoka, Simonoseki, Mitsuga, Hama, Matsugama, and Takamatsu (closed ports of Japan), arrived at Kobe November 2. Sailed January 25, 1888, and arrived at Hong-Kong February 1, where she remained until the 12th of that month, when she sailed for Singapore. She arrived at Singapore February 20, and sailed thence, after a visit of five days, for Batavia, reaching there February 28. Leaving this port March 4, she visited Macassar, Amboina, Termate, and Manila, arriving at the latter place March 30. Left April 8, touched at Amoy, and arrived at Shanghai April 19. Sailed April 22 to render assistance to the steamer *San Pablo*, ashore on Tan Rocks, and returned to Shanghai April 28, where she remained until May 6, when she sailed for Kobe, reaching that port May 12. Left May 20 and reached Yokohama two days later. Sailed on the 4th and arrived at Kobe on the 6th. Sailed August 9 for the United States, but put into Nagasaki on the 14th of that month, with a broken shaft. Left September 5 for New York, under sail, via Honolulu and Cape Horn. Arrived at Honolulu October 15, whence she sailed for home on November 10.

JUNIATA.

The *Juniata* arrived at Yokohama March 19, 1888, where she remained until the 24th of the following month, when she sailed for Shanghai, and, having touched at Kobe and Nagasaki, arrived there April 24. Sailed May 11, visited Amoy, and thence proceeded to Keelung, arriving May 19. Returned to Amoy a few days later, and from that port proceeded to Hong-Kong, Canton, and Whampoa; thence back to Hong-Kong, and left that port June 9 for Fuchow, where she arrived June 12. She remained here until June 16, and then left for Shanghai, arriving there a few days later. Sailed June 21, and arrived at Chemulpo June 25. Left this port August 29 for Nagasaki to assist in towing the *Brooklyn* to sea. Started out with her September 5, and returned to Nagasaki two days later. Sailed for New York September 18; arrived at Hong-Kong September 27; Singapore, October 6; Colombo, October 25; Aden, November 15, and Alexandria, Egypt, November 28.

EUROPEAN STATIONS.

Acting Rear-Admiral James A. Greer is still in command of the force on this station, which consists now of the *Lancaster*, *Quinnebaug*, and *Enterprise*. The *Pensacola* has been detached from the squadron and the *Lancaster* and *Enterprise* added to it during the year.

PENSACOLA.

The *Pensacola* sailed from Alexandria October 20; arrived at Jaffa on the 22d, left on the 25th, and reached Beyrout the next day. Sailed on the 21st for Smyrna, where she arrived November 4. She remained in that port until November 20, and left that day for Piræus, arriving November 22. Left the next day and arrived at Genoa November 29. Sailed December 16 and arrived at Villefranche the next day. She was detached from the squadron at this port, December 21, and sailed that day for Hampton Roads, Virginia, where she arrived February 18, 1888, having touched at Gibraltar and Madeira en route.

LANCASTER.

The *Lancaster* sailed from Montevideo January 18, 1888, for the European station, arrived at Gibraltar April 6, and at Villefranche, April 14. Rear-Admiral Greer hoisted his flag on board this ship two days later. Sailed May 10, and arrived at Spezia next day. She remained in that port until May 17, when she left and visited Ayaccio, Naples, Palermo, Port Mahon, and Barcelona, arriving at the latter place June 17. Sailed July 3, and reached Cadiz on the 8th. Left on the 19th, and arrived at Gibraltar the same day. Sailed August 6, visited Malaga, and arrived at Barcelona, August 18. Sailed October 15, and arrived at Villefranche on the 17th.

QUINNEBAUG.

The *Quinnebaug* sailed from Alexandria October 20, 1887, visited Sidon Tripoli, Latikiah, Ayas Bay, Mersyn, and arrived at Smyrna October 20; left the latter port November 6, and arrived at Constantinople two days later; she remained in this port until November 14, when she left for Smyrna, where she arrived on the 16th; sailed the next day, and after visiting Samos, Milo, and Zante arrived at Genoa November 29; sailed again on the 3d of December, and reached Villefranche the next day; here she remained until March 23, 1888, when she left for Spezia; she reached that port the next day, and after a visit of four days sailed for Villefranche, where she arrived March 29; leaving this port April 27, she proceeded to Malaga and thence to Gibraltar, arriving at the latter place May 1; left two days later, visited Tangiers and returned to Gibraltar May 5; sailed on the 10th and arrived at Barcelona May 13; she left this port May 26, and after visiting Messina, Syracuse, Venice, Trieste, Fiume, Sebenico, Ragusa, Cattaro, Antivari, and Corfu, arrived at Leghorn July 21; she remained at the latter port until September 8, when she sailed for Messina, where she arrived September 12; left on the 18th and arrived at Syracuse the same day, and thence proceeding to Zante and Suda Bay, arrived at Piræus September 27; sailed October 5; visited Syra, Smyrna, Chenak, and arrived at Constantinople October 18.

ENTERPRISE.

The *Enterprise* was put in commission at the navy-yard, New York, October 4, 1887, and sailed from Boston January 28, 1888, for the European station. She arrived at Gibraltar March 3, having touched at Fayal en route. Between March 10 and April 8, visited Tangier three times, returning to Gibraltar after each visit. She sailed from Gibraltar April 9, visit Beni Saf, Oran, Argen, and Algiers, and arrived at Villefranche April 26. She remained in this port until May 10, when she sailed for a cruise to the northward, touched at Gibraltar, Oporto, and Ferro, and arrived at Southampton May 30. Proceeding thence June 19, she visited the following places: Deal, Hull, New Castle-on-Tyne, North Shields, Drobak, Christiania, Horten, Copenhagen, Cronstadt, and arrived at St. Petersburg, July 30. She remained at this port until August 12. Thence proceeded to Stockholm, Neufahrwasser, Stettin, and Elsinore, and arrived at Leith September 17. Sailed September 30, visited Minden, Amsterdam, Flushing, Antwerp, and Havre, and arrived at Rouen October 22.

SPECIAL SERVICE.

The vessels on special service are the *Ranger*, *Despatch*, *Michigan*, and *Thetis*.

RANGER.

The *Ranger* returned to San Francisco June 22, 1888, and arrived at the navy-yard, Mare Island, California, July 5. Left November 12 to adjust her compasses and would then continue the survey of the coast of Lower California.

DESPATCH.

The *Despatch* has visited during the year at various times the following-named ports: Norfolk, Washington, Annapolis, Baltimore, Philadelphia, New York, Newport, Boston, Portsmouth, and Bar Harbor. She is now at Philadelphia.

MICHIGAN.

The *Michigan* has been employed during the past year in cruising on the northwestern lakes.

THETIS.

The *Thetis* left the navy-yard, Mare Island, California, November 13, 1887, and sailed from San Francisco for Alaska three days later, and touching at Port Townsend and Nanaimo arrived at Sitka December 4. Sailed December 12, and after visiting Schultz Cove, Lindenberg, Hooniah, Juneau, Prolewy Point, Wrangel, Loring, Port Chester, Ward's Cove, Fort Simpson, Cardina Bay, Oyster Bay, Departure Bay, and Port Townsend, returned to the Mare Island yard, arriving January 9, 1888. She remained at this yard until April 18, and anchored that day off San Francisco, from which place she sailed for Alaska April 28; arrived at Victoria May 1, and sailed thence for Sitka on the 6th, arriving at that port May 18, having touched at Departure Bay and Port Chester en route. Left Sitka May 27, touched at Port Mulgrave, Port Etches, Saint Paul, Coal Harbor, and Karluh; arrived at Ounalaska June 14. Then visited St. Paul, and again returned to Ounalaska. Left the latter port June 26, and arrived at the mouth of the Nushagah River two days later, and proceeding thence July 1, and touching at Belkoffski and Delaroff Harbor, returned to Ounalaska July 12. Sailed July 19 for St. Michaels and settlements in northern Alaska, and for the fishing grounds of the Arctic; arrived at East Cape July 24 and at St. Michaels July 27. Sailed the next day, and visited the settlements on King's Island, Cape Prince of Wales, Cape Blossom, Kotzebue Sound, and arrived off Cape Sabine, Arctic Ocean, August 8. Left the same day, and visited the settlements at Wainwright Inlet and Port Belchor. Between August 10 and 18 remained in the vicinity of Point Barrow, cruising among the vessels of the whaling fleet. Left Point Barrow August 18 and arrived at the Coal Veins, near Cape Sabine, August 20. Sailed August 30, and arrived at Port Clarence September 3, with American schooner *Jane Grey* in tow, which had been abandoned in the Arctic. Left on the 9th, and arrived at St. Michaels on the 11th. Sailed the next day, visited Ounalaska, and arrived at Sitka October 2. Sailed November 1, and arrived at Nanaimo November 11; arrived at Esquimalt November 14, and, leaving that place November 21, reached San Francisco November 25.

VESSELS NOT YET ASSIGNED TO ANY STATION.

BOSTON.

The *Boston* sailed from the navy-yard, New York, October 1, 1888, and arrived at Port Royal, Jamaica, on the 10th of that month; thence proceeded to Livingston, Guatemala, where she arrived October 17. After remaining in this port three days, sailed for the Corn Islands, where she arrived October 23. Sailed the next day and arrived at Greytown, Nicaragua, October 25; left on the 28th and arrived at Kingston, Jamaica, October 31. Left November 4 and arrived at Port au Prince on the 6th, and sailed thence for New York, November 16 and arrived on the 24th of that month.

KEARSARGE.

The *Kearsarge* was put in commission at the navy-yard, Portsmouth, N. H., November 2, 1888, and sailed for Hampton Roads on the 10th of that month, where she arrived November 14. Left November 14 and arrived at the navy-yard, Norfolk, the same day. Sailed for Monte Video with relief officers and men for Tallapoosa on November 30.

APPRENTICE TRAINING-SHIPS.

SARATOGA.

The *Saratoga*, after completion of repairs at Norfolk, sailed March 2, 1888, and anchored in Hampton Roads the same day. She remained in the Chesapeake Bay and adjacent waters until May 28, when she sailed for Newport, R. I., where she arrived June 1. Left for New York June 25 and arrived at that port June 29. Sailed July 16 and returned to Newport on the 20th; subsequently cruised in Narragansett Bay; arrived at the navy-yard, Portsmouth, N. H., August 24, and was put out of commission at that yard October 8, 1888.

JAMESTOWN.

The *Jamestown* sailed from the navy-yard, Norfolk, Va., March 7, 1888, and arrived at Hampton Roads the same day. Cruised in the Chesapeake Bay and adjacent waters until August 20, when she returned to Norfolk and was put out of commission at the navy-yard at that place August 31.

PORTSMOUTH.

The *Portsmouth* left the navy-yard, New York, January 9, 1888, and anchored in Hampton Roads January 13; arrived at the navy-yard, Norfolk, on the 17th. She remained at that place until February 3 following, when she sailed; cruised in the vicinity of Hampton Roads and Lynn Haven Bay, and left for the West Indies on the 17th of that month; arrived at Barbadoes March 9; left on the 22d, and reached Trinidad two days later. Proceeding thence April 5, she visited Basse-Terre and St. Thomas, and leaving the latter place April 28, arrived at Newport May 14. Sailed June 25; cruised in Vineyard Sound, and arrived at the navy-yard, Portsmouth, N. H., July 2. Went out of commission October 8, 1888.

CONSTELLATION.

The *Constellation* was commissioned at the Naval Academy September 1, 1888, for temporary service as a training-ship; sailed for Norfolk September 3, where she arrived September 13, having stopped at Hampton Roads en route. Left that port September 22 for Portsmouth, N. H., and arrived there October 2. After receiving the apprentices from the *Portsmouth* and *Saratoga*, sailed for Hampton Roads, and thence, November 1, for a cruise in the West Indies.

No. 18.—TABULAR STATEMENT OF PROPOSALS RECEIVED AND OPENED IN THE OFFICE OF THE SECRETARY OF THE NAVY BETWEEN DECEMBER 6, 1887, AND DECEMBER 1, 1888.

[A * marks each successful bid.]

SCHEDULE OF PROPOSALS FOR MACHINE TOOLS FOR THE ORDNANCE GUN-SHOPS, NAVY-YARD, WASHINGTON, D. C., UNDER ADVERTISEMENT DATED NOVEMBER 2, 1887.

GROUP 1.

Turning and boring lathes for 16-inch B. L. rifles.

For one lathe:	
Niles Tool Works	$69,500.00
Bement, Miles & Co	71,000.00
The Pond Machine Tool Company	70,000.00
Southwark Foundry and Machine Company	101,959.00
For two lathes:	
Niles Tool Works	137,000.00
Bement, Miles & Co	139,550.00
The Pond Machine Tool Company	139,000.00
Southwark Foundry and Machine Company	174,786.00
For three lathes:	
Niles Tool Works	205,600.00
Bement, Miles & Co	209,800.00
The Pond Machine Tool Company	207,800.00
Southwark Foundry and Machine Company	240,330.00
For four lathes:	
Niles Tool Works	273,000.00
Bement, Miles & Co	279,800.00
The Pond Machine Tool Company	276,200.00
Southwark Foundry and Machine Company	291,312.00
For five lathes:	
Niles Tool Works	341,000.00
Bement, Miles & Co	349,800.00
The Pond Machine Tool Company	345,200.00
Southwark Foundry and Machine Company	364,140.00
For six lathes:	
Niles Tool Works	406,800.00
Bement, Miles & Co	419,800.00
The Pond Machine Tool Company	414,200.00
Southwark Foundry and Machine Company	436,968.00

GROUP 2.

Turning and boring lathes for 16-inch B. L. rifle jackets.

For one lathe:	
Niles Tool Works	42,000.00
Bement, Miles & Co	39,500.00
The Pond Machine Tool Company	41,000.00
Southwark Foundry and Machine Company	63,646.00
For two lathes:	
Niles Tool Works	83,000.00
Bement, Miles & Co	78,500.00
The Pond Machine Tool Company	80,500.00
Southwark Foundry and Machine Company	109,108.00

For three lathes:	
Niles Tool Works	$123,000.00
Bement, Miles & Co	117,500.00
The Pond Machine Tool Company	120,500.00
Southwark Foundry and Machine Company	136,383.00

GROUP 3.

Turning and boring lathes for 16-inch B. L. rifle hoops.

For three lathes:	
Binsse & Hauschild	*45,000.00
Niles Tool Works	a78,000.00 b93,000.00
Bement, Miles & Co	a81,000.00 b96,000.00
The Pond Machine Tool Company	a76,500.00 b91,500.00
Southwark Foundry and Machine Company	77,200.00
For four lathes:	
Binsse & Hauschild	56,000.00
Niles Tool Works	a103,000.00 b123,000.00
Bement, Miles & Co	a135,000.00 b140,000.00
The Pond Machine Tool Company	a101,700.00 b121,300.00
Southwark Foundry and Machine Company	93,576.00
For seven lathes:	
Binsse and Hauschild	100,000.00
Niles Tool Works	a180,000.00 b215,000.00
Bement, Miles & Co	a189,000.00 b204,000.00
The Pond Machine Tool Company	a177,100.00 b211,300.00
Southwark Foundry and Machine Company	163,758.00

GROUP 4.

Turning and boring lathe for 6-inch B. L. rifles.

For one lathe:	
Albert Flagler	10,650.00
Niles Tool Works	20,850.00
Bement, Miles & Co	*19,950.00

GROUP 5.

Turning and boring lathes for 6-inch B. L. rifle hoops.

For five lathes:		
Albert Flagler		19,750.00
Fitchburg Machine Works, $4,783 each		23,915.00
Israel H. Johnson, jr., & Co		*23,298.00
Niles Tool Works		53,750.00 63,000.00
The Pond Machine Tool Company	$10,200 each 12,500 each	51,000.00 62,500.00
Bement, Miles & Co	11,250 each 12,870 each	56,250.00 64,350.00
Detrick & Harvey		*15,342.00
For ten lathes:		
Albert Flagler		39,500.00
Fitchburg Machine Works, $4,783 each		47,830.00
Israel H. Johnson, jr., & Co		43,285.00
Detrick & Harvey		30,084.00

GROUP 6.

Slotter for 6-inch B. L. rifle trunnion bands.

For one slotter:

S. C. Forsaith Machine Company	$5,016.98
Niles Tool Works { A, crank slotter	7,500.00
Niles Tool Works { B, geared slotter	7,500.00
Bement, Miles & Co	7,950.00

SCHEDULE OF PROPOSALS FOR TOOLS FOR THE NAVY-YARD, BROOKLYN, N. Y., UNDER ADVERTISEMENT DATED NOVEMBER 25, 1887.

Class 1:	
Manning, Maxwell & Moore	$2,950.00
Bement, Miles & Co	*3,150.00
S. C. Forsaith Machine Company	3,180.00
Niles Tool Works	3,184.00
Class 2:	
Manning, Maxwell & Moore	2,650.00
Bement, Miles & Co	*3,150.00
S. C. Forsaith Machine Company	3,080.00
Niles Tools Works	3,060.00
Class 3:	
Manning, Maxwell & Moore	1,680.00
Bement, Miles & Co	*1,800.00
S. C. Forsaith Machine Company	2,450.00
Niles Tool Works	1,960.00
Class 4:	
Manning, Maxwell & Moore	785.00
Bement, Miles & Co	*850.00
S. C. Forsaith Machine Company	925.00
Niles Tool Works	922.00
Class 5:	
Bement, Miles & Co	4,200.00
S. C. Forsaith Machine Company	*2,350.00
Niles Tool Works	4,450.00
Class 6:	
Bement, Miles & Co	6,950.00
S. C. Forsaith Machine Company	*4,600.00
Niles Tool Works	6,000.00
Class 7:	
Bement, Miles & Co	2,400.00
Niles Tool Works	*2,100.00
Class 8:	
Manning, Maxwell & Moore	*1,475.00
Bement, Miles & Co	1,575.00
Niles Tool Works	1,592.00
Class 9:	
Niles Tool Works	*3,530.00
Class 10:	
Niles Tool Works	*3,245.00
Class 11:	
Bement, Miles & Co	4,400.00
Putnam Machine Company	2,753.50
Niles Tool Works	*3,300.00
Class 12:	
Manning, Maxwell & Moore	1,784.00
Bement, Miles & Co	1,600.00
S. C. Forsaith Machine Company	934.00
Donegan & Swift	{ 630.00
	{ *660.00
Niles Tool Works	1,700.00
Class 13:	
Bement, Miles & Co	*700.00
Niles Tool Works	850.00
Class 14:	
Bement, Miles & Co	*650.00
Class 15:	
Bement, Miles & Co	*6,500.00
Niles Tool Works	7,000.00

Class 16:	
Bement, Miles & Co	$6,750.00
Niles Tool Works	*5,950.00
Class 17:	
S. C. Forsaith Machine Company	*2,156.00
Niles Tool Works	4,250.00
Class 18:	
Bement, Miles & Co	1,750.00
Donegan & Swift	1,600.00
James W. Soper	1,195.00 *1,230.00 2,185.00
Class 19:	
Lidgerwood Manufacturing Company	1,880.00
S. C. Forsaith Machine Company	1,750.00
Donegan & Swift	1,575.00
James W. Soper	980.00 *1,260.00
Class 21:	
Niles Tool Works	*2,500.00
Class 23:	
B. F. Sturtevant	*850.00
Manning, Maxwell & Moore	440.00
Class 24:	
Manning, Maxwell & Moore	276.00
Donegan & Swift	201.00
S. C. Forsaith Machine Company	237.00
R. A. Robbins	237.60
B. F. Sturtevant	*175.00
Class 25:	
Niles Tool Works	*2,200.00
The Builders' Iron Foundry	2,750.00
Class 26:	
Donegan & Swift	900.00
Niles Tool Works	*850.00
Class 27:	
Niles Tool Works	*2,050.00
Class 28:	
Niles Tool Works	*3,730.00
Class 29:	
Niles Tool Works	*4,700.00
Class 30:	
R. A. Robbins	*989.00
Class 31:	
Fraser & Archer	249.00
Manning, Maxwell & Moore	275.00
Donegan & Swift	*215.00
The Pratt & Whitney Company	411.00
Putnam Machine Company	330.00 350.00
R. A. Robbins	436.90
Class 32:	
Fraser & Archer	220.00
Manning, Maxwell & Moore	310.00
Donegan & Swift	*155.00
R. A. Robbins	597.00
Class 33:	
Manning, Maxwell & Moore	350.00
Donegan & Swift	212.50
John Swan & Co	325.00
The Pratt & Whitney Company. No. 9	450.00
The Pratt & Whitney Company. No. 8	400.00
R. A. Robbins	295.00
James W. Soper	*177.50
S. C. Forsaith Machine Company	412.50
Class 34:	
Manning, Maxwell & Moore	195.00
Donegan & Swift	131.25
John Swan & Co	193.75
The Pratt & Whitney Company	350.00

Class 34—Continued.	
S. C. Forsaith Machine Company	$246.75
R. A. Robbins	174.25
James W. Soper	*105.00
Class 35:	
Manning, Maxwell & Moore	237.50
Donegan & Swift	156.25
John Swan & Co.	231.25
S. C. Forsaith Machine Company	296.75
R. A. Robbins	211.75
James W. Soper	*116.25
Class 36:	
Manning, Maxwell & Moore	259.00
Donegan & Swift	196.00
John Swan & Co	295.75
Excelsior Tool Company	203.00
S. C. Forsaith Machine Company	278.25
R. A. Robbins	218.75
James W. Soper	*157.50
Class 37:	
Manning, Maxwell & Moore	160.00
Donegan & Swift	150.00
John Swan & Co	183.80
Excelsior Tool Company	180.00
S. C. Forsaith Machine Company	167.00
R. A. Robbins	187.50
James W. Soper	*80.00
Class 38:	
Manning, Maxwell & Moore	203.00
Donegan & Swift	208.60
John Swan & Co	233.80
Excelsior Tool Company	224.00
S. C. Forsaith Machine Company	227.50
R. A. Robbins	227.50
James W. Soper	*105.00
Class 39:	
Manning, Maxwell & Moore	184.00
Donegan & Swift	*176.00
R. A. Robbins	195.84
James W. Soper	171.84
Class 40:	
Manning, Maxwell & Moore	245.00
Donegan & Swift	*229.25
R. A. Robbins	317.80
James W. Soper	219.10
Class 41:	
Fraser & Archer	*516.50
Donegan & Swift	517.00
R. A. Robbins	577.00
James W. Soper	566.50
Class 42:	
Fraser & Archer	*163.20
Donegan & Swift	176.20
R. A. Robbins	193.80
James W. Soper	187.28
Class 43:	
Fraser & Archer	*180.00
Donegan & Swift	192.48
R. A. Robbins	239.40
James W. Soper	235.08
Class 44:	
Fraser & Archer	*84.00
Donegan & Swift	88.02
R. A. Robbins	110.40
James W. Soper	93.48
Class 45:	
Fraser & Archer	*127.05
Donegan & Swift	137.50
R. A. Robbins	167.20
James W. Soper	145.42

Class 46:	
Fraser & Archer	*$45.30
Donegan & Swift	49.50
R. A. Robbins	60.78
James W. Soper	53.16
Class 47:	
Fraser & Archer	*6.16
Donegan & Swift	7.42
R. A. Robbins	10.20
James W. Soper	9.70
Class 48:	
Fraser & Archer	*2.70
Donegan & Swift	3.46
R. A. Robbins	3.84
James W. Soper	3.70
Class 49:	
Fraser & Archer	12,950.00
Robert Wetherill & Co	*9,700.00

SCHEDULE OF PROPOSALS FOR A SUBMARINE TORPEDO-BOAT, UNDER ADVERTISEMENT DATED NOVEMBER 26, 1887.

The William Cramp & Sons Ship and Engine Building Company	$175,000.00
Do	135,000.00
George C. Baker	

SCHEDULE OF PROPOSALS FOR TOOLS FOR THE NAVY-YARD, PORTSMOUTH, VA., UNDER ADVERTISEMENT DATED JANUARY 12, 1888.

Class 1:	
William Sellers & Co	$17,800.00
Bement, Miles & Co	15,500.00
Niles Tool Works	*15,200.00
Class 2:	
William Sellers & Co	2,826.00
Niles Tool Works	*2,600.00
Class 3:	
William Sellers & Co	*5,030.00
Bement, Miles & Co	6,750.00
Niles Tool Works	6,500.00
James W. Soper	5,199.00
Class 4:	
William Sellers & Co	5,060.00
Manning, Maxwell & Moore	*2,450.00
Bement, Miles & Co	2,550.00
Niles Tool Works	2,600.00
Class 5:	
William Sellers & Co	1,695.00
Manning, Maxwell & Moore	2,538.00
Bement, Miles & Co	2,500.00
Niles Tool Works	2,600.00
Class 6:	
Morgan Engineering Company	25,800.00
H. B. Smith Machine Company	12,240.00
Classes 7 and 8:	
William Sellers & Co	1,890.00
Universal Radial Drill Company	890.00
Bement, Miles & Co	*†1,600.00
Donegan & Swift	1,460.00
H. B. Smith Machine Company	1,650.00
Albert Flagler	1,100.00
Niles Tool Works	1,750.00
James W. Soper	1,400.00
Class 9:	
Universal Radial Drill Company	*260.00
Bement, Miles & Co	650.00
Donegan and Swift	685.00

† Contracts awarded for part only of the classes.

Class 10:	
William Sellers & Co	$3,856.00
Manning, Maxwell & Moore	3,775.00
Universal Radial Drill Company	*2,400.00
Edwin Harrington, Son & Co	3,300.00
Albert Flagler	3,000.00
Niles Tool Works	3,800.00
Classes 11, 12, and 13:	
Bement, Miles & Co	*†3,525.00
Class 14:	
Manning, Maxwell & Moore	387.00
Donegan & Swift	453.00
Thomas H. Dallett	346.00
Albert Flagler	395.00
S. C. Forsaith Machine Company	*374.50
Classes 15 and 16:	
William Sellers & Co	7,458.00
Bement, Miles & Co	*7,200.00
Niles Tool Works	7,500.00
James W. Soper	9,840.00
Class 17:	
William Sellers & Co	2,184.00
Manning, Maxwell & Moore	2,340.00
Detrick & Harvey	3,410.00
Bement, Miles & Co	2,275.00
Niles Tool Works	2,400.00
Classes 18 and 19:	
William Sellers & Co	6,166.00
Morgan Engineering Company	6,960.00
Bement, Miles & Co	9,400.00
Niles Tool Works	9,000.00
Classes 20, 21, 22, and 23:	
William Sellers & Co	11,456.00
Manning, Maxwell & Moore	11,000.00
Morgan Engineering Company	*†9,120.00
Bement, Miles & Co	11,600.00
Donegan & Swift	7,460.00
Niles Tool Works	11,800.00
Stiles & Parker Press Company	11,900.00
Class 24:	
William Sellers & Co	4,185.00
Morgan Engineering Company	4,800.00
Bement, Miles & Co	5,200.00
Niles Tool Works	5,050.00
Class 25:	
Bement, Miles & Co	*2,800.00
Niles Tool Works	2,850.00
Class 26:	
William Sellers & Co	3,088.00
Morgan Engineering Company	3,375.00
H. B. Smith Machine Company	4,800.00
Niles Tool Works	*3,000.00
Class 27:	
William Sellers & Co	13,830.00
Morgan Engineering Company	31,500.00
Bement, Miles & Co	11,000.00
H. B. Smith Machine Company	9,800.00
James W. Soper	7,200.00
Class 28:	
Manning, Maxwell & Moore	400.00
Donegan & Swift	365.00
S. C. Forsaith Machine Company	*387.50
B. F. Sturtevant	485.00
Classes 29 and 30:	
S. C. Forsaith Machine Company	*†949.00
Class 31:	
Williamson Brothers	375.00
Class 32:	
Bement, Miles & Co	1,100.00
H. B. Smith Machine Company	1,150.00

† Contracts awarded for a part only of the classes.

Class 32—Continued.	
Albert Flagler	$1,298.00
Hendey Machine Company	700.00
Class 33:	
Donegan & Swift	265.00
Albert Flagler	250.00
James W. Soper	*193.00
Class 34:	
Springfield Glue and Emery Wheel Company	*216.00
Manning, Maxwell & Moore	257.00
Donegan & Swift	268.00
Diamond Emery Wheel and Machine Company	130.00
Class 35:	
Springfield Glue and Emery Wheel Company	*440.00
Donegan & Swift	525.00
Class 36:	
William Sellers & Co	2,176.00
Class 37:	
Fraser & Archer	417.50
Donegan & Swift	467.00
Albert Flagler	485.50
James W. Soper	423.00
Compound Corliss engine:	
Robert Wetherill & Co	5,470.00
Richmond Locomotive and Machine Works	*5,976.00
Niles Tool Works	6,500.00
Lewes & Phillips	6,275.00
Class 38:	
George V. Cresson	2,015.42
William Sellers & Co	1,657.44
Richmond Locomotive and Machine Works	1,768.73
Fraser & Archer	*1,429.43
Donegan & Swift	1,997.59
Albert Flagler	1,979.06

SCHEDULE OF PROPOSALS FOR THE CONSTRUCTION OF A NEW NAVAL OBSERVATORY, ON GEORGETOWN HEIGHTS, WASHINGTON, D. C., UNDER ADVERTISEMENT DATED APRIL 10, 1888.

With indirect radiation for main building.

McCarthy & Baldwin	$312,936.00
William Rothwell	‡328,644.00
Thomas & Driscoll	309,191.81
Maine Granite and Improvement Company	331,940.00
Michael A. McGowan	‡338,861.00
Philip Walsh & Sons	331,692.00
P. H. McLaughlin & Co	*‡337,811.00
F. H. Duehay	‡330,517.81
A. G. Campfield	{ 299,000.00 { 303,000.00
Bright & Humphrey	‡339,264.00

With direct radiation for main building.

McCarthy & Baldwin	‡310,342.00
William Rothwell	324,628.00
Maine Granite and Improvement Company	331,043.00
Michael A. McGowan	‡333,919.00
Philip Walsh & Sons	329,692.00
P. H. McLaughlin & Co	‡293,367.00
F. H. Duehay	‡331,653.12
Bright & Humphrey	‡335,957.00

SCHEDULE OF PROPOSALS FOR STEEL FOR USE IN THE CONSTRUCTION OF THE UNITED STATES ARMORED CRUISER MAINE, UNDER ADVERTISEMENT DATED MAY 4, 1888.

Class A, steel plates:	
Linden Steel Company, Limited	$120,422.40
Carnegie, Phipps & Co., Limited	*89,779.20
Chester Rolling Mills	111,240.00

‡ Bid under modified specifications.

Class B, steel shapes:	
Carnegie, Phipps & Co., Limited	*$35,986.49
Class C, steel rivets:	
Oliver Brothers & Phillips	10,584.00
Carnegie, Phipps & Co., Limited	*9,737.28
Class D, steel castings:	
Standard Steel Casting Company, at 18¼ cents per pound.	
Midvale Steel Company	56,448.00
Pittsburgh Steel Casting Company	*50,176.00

SCHEDULE OF PROPOSALS FOR STEEL FOR USE IN THE CONSTRUCTION OF THE UNITED STATES ARMORED BATTLE-SHIP TEXAS, UNDER ADVERTISEMENT DATED JUNE 21, 1888.

Class A, steel plates:	
Park, Brother & Co., Limited	*$66,769.92
Carnegie, Phipps & Co., Limited	73,982.72
Linden Steel Company, Limited	86,553.60
Class B, steel shapes:	
Carnegie, Phipps & Co., Limited	*43,266.05
Class C, steel rivets:	
Oliver Brothers & Phillips	8,960.00
Carnegie, Phipps & Co., Limited	*8,601.60
George L. Neville	10,079.78
Class D, steel castings:	
Standard Steel Casting Company	*41,664.00

SCHEDULE OF PROPOSALS FOR MACHINE FINISHING AND CONSTRUCTING STEEL B. L. RIFLES, UNDER ADVERTISEMENT DATED JUNE 25, 1888.

For six 6-inch B. L. Rifles:	
West Point Foundry Company	*$20,400.00
South Boston Iron Works	*20,400.00
For twelve 6-inch B. L. Rifles:	
West Point Foundry Company	40,800.00
South Boston Iron Works	40,800.00

SCHEDULE OF PROPOSALS FOR MATERIALS FOR USE IN THE CONSTRUCTION OF THE UNITED STATES ARMORED CRUISER MAINE, UNDER ADVERTISEMENT DATED JULY 10, 1888.

Class	
Lewis H. Ross	*$123.24
Class 7:	
Joseph W. Duryee	*6,642.86
Class 13:	
Joseph W. Duryee	5,211.49
Lewis H. Ross	*4,405.00
Class 15:	
Joseph W. Duryee	*1,409.80
Lewis H. Ross	1,423.10
Class 18:	
Joseph W. Duryee	1,526.50
Lewis H. Ross	*1,169.00
Class 18 A:	
Joseph W. Duryee	*795.00
Lewis H. Ross	847.50
Class 19:	
Joseph W. Duryee	*77.00
Class 23:	
Joseph W. Duryee	*400.00
Class 25:	
Joseph W. Duryee	*120.00
Lewis H. Ross	150.00
Class 32:	
Henry B. Newhall	1,250.00
R. A. Robbins	*1,478.00

Class 33:	
Henry B. Newhall	$932.50
R. A. Robbins	*1,097.70
Class 37:	
Henry B. Newhall	1,109.12
Class 39:	
Albert Flaglor	165.13
James J. Donovan	*150.30
F. T. Witte Hardware Company	198.35
R. A. Robbins	179.89
Class 42:	
Albert Flagler	310.00
R. A. Robbins	*270.00
Class 44:	
R. A. Robbins	*997.43
Class 48:	
Albert Flagler	661.46
James J. Donovan	*572.41
F. T. Witte Hardware Company	606.00
R. A. Robbins	687.83
Class 49:	
Calvin A. Baynon	*396.85
Albert Flagler	412.65
James J. Donovan	472.60
F. T. Witte Hardware Company	482.55
R. A. Robbins	433.36
Class 54:	
Albert Flagler	*9,708.54
James J. Donovan	10,356.99
F. T. Witte Hardware Company	12,959.70
R. A. Robbins	10,052.23
Class 56:	
Albert Flagler	720.00
James J. Donovan	720.00
R. A. Robbins	681.00
W. B. Price Manufacturing Company	*675.00
Class 57:	
Albert Flagler	*550.00
James J. Donovan	625.00
R. A. Robbins	610.00
W. B. Price Manufacturing Company	575.00
Class 58:	
Albert Flagler	1,635.40
James J. Donovan	1,681.85
R. A. Robbins	1,531.90
W. B. Price Manufacturing Company	*1,184.72
Class 59:	
James J. Donovan	*765.00
R. A. Robbins	795.00
Class 60:	
Albert Flagler	612.00
James J. Donovan	530.25
R. A. Robbins	*519.40
Class 61:	
James J. Donovan	*275.00
Class 63:	
James J. Donovan	*71.40
Class 68:	
Albert Flagler	*89.42
Class 69:	
Albert Flagler	521.10
James J. Donovan	387.00
R. A. Robbins	368.40
W. B. Price Manufacturing Company	*311.85
Class 73:	
R. A. Robbins	*20.05
Class 78:	
James J. Donovan	80.00
R. A. Robbins	*40.80

SCHEDULE OF PROPOSALS FOR MATERIALS FOR USE IN THE CONSTRUCTION OF THE UNITED STATES UNARMORED STEEL CRUISER NEWARK, UNDER ADVERTISEMENT DATED AUGUST 2, 1888.

Class 23:	
Joseph W. Duryee	*$270.00
Mast plates:	
Park Brother & Co	*1,135.19
Rivets:	
R. A. Robbins	166.49

SCHEDULE OF PROPOSALS FOR MATERIALS FOR USE IN THE CONSTRUCTION OF THE UNITED STATES GUN-BOAT PETREL, UNDER ADVERTISEMENT DATED AUGUST 2, 1888.

Class 32:	
R. A. Robbins	$250.00
E. J. Griffith & Co	*222.35
Class 33:	
R. A. Robbins	105.85
E. J. Griffith & Co	*80.82
Class 35:	
R. A. Robbins	*16.10
E. J. Griffith & Co	24.80
Class 43:	
R. A. Robbins	*12.60
E. J. Griffith & Co	16.62
Class 44:	
R. A. Robbins	*86.91
E. J. Griffith & Co	87.00
Class 48:	
F. T. Witte Hardware Company	43.50
R. A. Robbins	*32.70
E. J. Griffith & Co	36.90
Class 49:	
F. T. Witte Hardware Company	*22.59
E. J. Griffith & Co	32.72
Class 54:	
F. T. Witte Hardware Company	93.30
R. A. Robbins	*65.23
E. J. Griffith & Co	68.35
Class 56:	
R. A. Robbins	*24.80
E. J. Griffith & Co	26.00
Class 57:	
R. A. Robbins	*3.20
E. J. Griffith & Co	6.00
Class 58:	
R. A. Robbins	*8.24
E. J. Griffith & Co	14.65
Class 59:	
R. A. Robbins	*9.00
E. J. Griffith & Co	10.50
Class 60:	
R. A. Robbins	115.15
E. J. Griffith & Co	*55.50
Class 68:	
R. A. Robbins	*68.00
Class 70:	
R. A. Robbins	*52.15
E. J. Griffith & Co	70.50
Class 73:	
R. A. Robbins	*25.70
E. J. Griffith & Co	116.50
Class 90:	
R. A. Robbins	*119.60

SCHEDULE OF PROPOSALS FOR MATERIALS FOR USE IN THE CONSTRUCTION OF THE UNITED STATES UNARMORED STEEL CRUISER SAN FRANCISCO, UNDER ADVERTISEMENT DATED AUGUST 2, 1888.

Mast-plates:	
Park, Brother & Co	*$1,475.49
Austin & Phelps	2,311.01
William H. Quinn	1,884.36
Dunham, Carrigan and Hayden Company	1,955.47
T-bars:	
Austin & Phelps	*485.75
William H. Quinn	403.54
Dunham, Carrigan and Hayden Company	448.38
Angle-bars:	
Austin & Phelps	*275.10
William H. Quinn	243.00
Dunham, Carrigan and Hayden Company	275.10
Rivets:	
Austin & Phelps	*219.11
William H. Quinn	194.62
Dunham, Carrigan and Hayden Company	321.39

SCHEDULE OF PROPOSALS FOR MATERIALS FOR USE IN THE CONSTRUCTION OF THE UNITED STATES UNARMORED STEEL CRUISER BALTIMORE, UNDER ADVERTISEMENT DATED AUGUST 2, 1888.

Class 5:	
Joseph W. Duryee	*$1,064.20
William R. Adams & Co	1,159.53
Lewis H. Ross	1,146.48
Class 13:	
Joseph W. Duryee	875.55
William R. Adams & Co	*857.25
Lewis H. Ross	883.00
Class 15:	
Joseph W. Duryee	667.25
William R. Adams & Co	677.65
Lewis H. Ross	*655.50
Class 18:	
Joseph W. Duryee	996.25
William R. Adams & Co	1,026.50
Lewis H. Ross	*966.00
Class 18 A:	
Joseph W. Duryee	*487.50
William R. Adams & Co	503.75
Lewis H. Ross	520.00
Class 22:	
Joseph W. Duryee	577.50
William R. Adams & Co	603.75
Lewis H. Ross	630.00
Charles F. Hodsdon	*567.00
Class 23:	
Joseph W. Duryee	*300.00
Lewis H. Ross	373.00
Class 24:	
Joseph W. Duryee	*187.00
Class 25:	
Joseph W. Duryee	*187.50
Lewis H. Ross	195.00
Class 26:	
William R. Adams & Co	*119.50
R. A. Robbins	345.80
N. L. Archer	231.00
Class 32:	
Columbia Iron Company ... per pound	0.02¼
R. A. Robbins	*123.23
Class 33:	
Columbia Iron Company ... per pound	0.02¼
R. A. Robbins	*96.90

Class 35:	
R. A. Robbins	*$12.00
Class 39:	
N. L. Archer	82.55
F. T. Witte Hardware Company	*66.35
Class 48:	
R. A. Robbins	174.87
Albert Flagler	170.67
N. L. Archer	180.04
F. T. Witte Hardware Company	*151.00
Class 49:	
Albert Flagler	*152.24
N. L. Archer	158.67
F. T. Witte Hardware Company	162.19
Class 50:	
Albert Flagler	*34.05
N. L. Archer	38.49
F. T. Witte Hardware Company	34.62
Class 54:	
R. A. Robbins	396.66
Albert Flagler	*282.53
N. L. Archer	289.51
F. T. Witte Hardware Company	316.52
Class 56:	
R. A. Robbins	*61.95
Albert Flagler	63.00
N. L. Archer	68.25
Class 57:	
R. A. Robbins	12.00
Albert Flagler	*11.00
N. L. Archer	11.80
Class 58:	
R. A. Robbins	*64.95
N. L. Archer	66.15
Class 59:	
R. A. Robbins	*34.20
N. L. Archer	34.80
Class 60:	
R. A. Robbins	46.90
N. L. Archer	41.25
Excelsior Varnish Works	*37.20
Class 69:	
R. A. Robbins	12.90
N. L. Archer	*7.65
Class 70:	
R. A. Robbins	*330.20
N. L. Archer	347.13
Class 73:	
R. A. Robbins	177.85
N. L. Archer	*31.40
Class 78:	
R. A. Robbins	*43.75
N. L. Archer	75.00
Mast plates:	
Park, Brother & Co	*560.89
Rivets:	
R. A. Robbins	*45.92

SCHEDULE OF PROPOSALS FOR FURNISHING COIL BOILERS FOR U. S. NAVY, UNDER DATE OF AUGUST 2, 1888.

Charles Ward	$20,960.00
Frank B. King	26,000.00
The Hohenstein Manufacturing Company	66,000.00
William Cowles	a23,800.00 b25,800.00

† Award not yet made.

SCHEDULE OF PROPOSALS FOR MATERIALS FOR USE IN THE CONSTRUCTION OF THE UNITED STATES UNARMORED STEEL CRUISER PHILADELPHIA, UNDER ADVERTISEMENT DATED AUGUST 2, 1888.

Class 23:		
Joseph W. Duryeo		*$300.00
Mast-plates:		
Park, Brother & Co		*1,135.18
Rivets:		
R. A. Robbins		*166.49

SHEDULE OF PROPOSALS FOR MATERIALS AND ARTICLES FOR USE IN THE CONSTRUCTION OF THE MACHINERY OF THE UNITED STATES MONITOR MONADNOCK, UNDER ADVERTISEMENT DATED SEPTEMBER 29, 1888.

Class 20:		
William Walker, coke		$21.00
A. S. Carman, coke		22.50
A. S. Carman, coal		34.00
James McCudden, coke		*20.00
James McCudden, coal		*32.50
Class 35:		
William Walker		1,487.50
A. S. Carman		*1,268.75
James McCudden		1,312.50
Class 38 A:		
Midvale Steel Company 40 cents per pound		11,261.00
Bethlehem Iron Company		9,300.00
Vulcan Iron Works		*7,290.00
Class 38 B:		
Continental Iron Works		*6,000.00
Class 38 C:		
Merchant & Co		4,125.00
W. C. Cobb		*1,440.00
Vulcan Iron Works		2,881.00
Class 39 A:		
R. A. Robbins	per pound	.349
William C. Codd	do	.29
Austin & Phelps	do	*.30
Class 39 B:		
William Walker	do	.305
Rowland A. Robbins	do	*.324
Austin & Phelps	do	.28
Class 39 C:		
Midvale Steel Company	do	*.26
Standard Steel Casting Company	do	.20
Class 42:		
William Walker		a36.50 b34.50
A. S. Carman		a42.00 b38.00
James McCudden		a 40.00 b37.00
W. A. Shaw		*a34.00 *b34.00
Class 44 A:		
George W. Gibbs & Co	per pound	.0565
Class 44 B:		
George W. Gibbs & Co	do	.0640
Class 44 C:		
Midvale Steel Company	do	*.15
George W. Gibbs & Co	do	a .0465 b .05½
Class 44 D:		
Midvale Steel Company	do	* a .30 * b .15 * c .18 * d .28

Class 53 A:	
S. C. Forsaith Machine Company	*$2,495.00
Class 53 B:	
Rowland A. Robbins	2,387.00
Ansonia Brass and Copper Company	2,387.00
Merchant & Co	2,333.00
Abner Doble	*2,307.00
Austin and Phelps	2,800.00
Class 56:	
Rowland A. Robbins	a.0867 b.0897
George W. Gibbs & Co	.06

SCHEDULE OF PROPOSALS FOR THE CONSTRUCTION OF A BOAT-HOUSE AT THE NAVAL ACADEMY, ANNAPOLIS, MD., UNDER ADVERTISEMENT DATED OCTOBER 10, 1888.

George H. Morrow	*$24,324
Lewis C. McCusker	29,827
John Stack & Sons	30,402
John Cowan	31,600
William Romsey, J. T. Layfield	25,883
Philip Walsh & Son	32,507
Charles Ogle	26,800

SCHEDULE OF PROPOSALS FOR MATERIALS FOR USE IN THE CONSTRUCTION OF THE UNITED STATES UNARMORED STEEL CRUISER CHARLESTON, UNDER ADVERTISEMENT DATED AUGUST 2, 1888.

Class 4:	
James McCudden	*$991.94
A. Powell	1,049.49
Class 10:	
James McCudden	1,445.00
A. Powell	*1,275.00
Class 13:	
James McCudden	271.80
A. Powell	286.90
William Walker	*256.70
Class 15:	
James McCudden	804.57
A. Powell	831.04
William Walker	*691.72
Class 18:	
James McCudden	40.00
A. Powell	42.00
William Walker	*39.00
Class 19:	
James McCudden	*85.80
A. Powell	90.48
Class 22:	
James McCudden	611.99
A. Powell	644.20
William Walker	*579.78
Class 24:	
James McCudden	400.00
A. Powell	412.50
William Walker	*400.00
Class 26:	
James McCudden	*204.60
A. Powell	115.32
Class 30:	
Austin & Phelps	*24.34
William H. Quinn	21.21
Dunham, Carrigan & Hayden Company	32.20
Class 32:	
Austin & Phelps	*46.50
William H. Quinn	21.05
Dunham, Carrigan & Hayden Company	23.25

Class 38:	
Austin & Phelps	*$253.00
William H. Quinn	23.93
Dunham, Carrigan & Hayden Company	33.75
Class 39:	
Austin & Phelps	*12.75
William H. Quinn	12.35
Dunham, Carrigan and Hayden Company	17.15
Class 48:	
William H. Quinn	75.27
Dunham, Carrigan & Hayden Company	163.50
Class 49:	
Austin & Phelps	*199.90
William H. Quinn	145.02
Dunham, Carrigan & Hayden Company	155.80
Class 54:	
William H. Quinn	59.89
Dunham, Carrigan & Hayden Company	79.70
Mast-plates:	
Park, Brother & Co	*962.68
Austin & Phelps	1,507.80
William H. Quinn	1,229.44
Dunham, Carrigan & Hayden Company	1,275.83
Angle-bars:	
Austin & Phelps	*105.84
William H. Quinn	93.49
Dunham, Carrigan & Hayden Company	105.84
Rivets:	
Austin & Phelps	*87.75
William H. Quinn	73.57
Dunham, Carrigan & Hayden Company	121.50

SUBJECT-INDEX—SECRETARY'S REPORT.

INDEX TO REPORTS FORMING THE APPENDIX.

11294—N 88——37

GENERAL INDEX TO APPENDIX OF REPORT OF SECRETARY.